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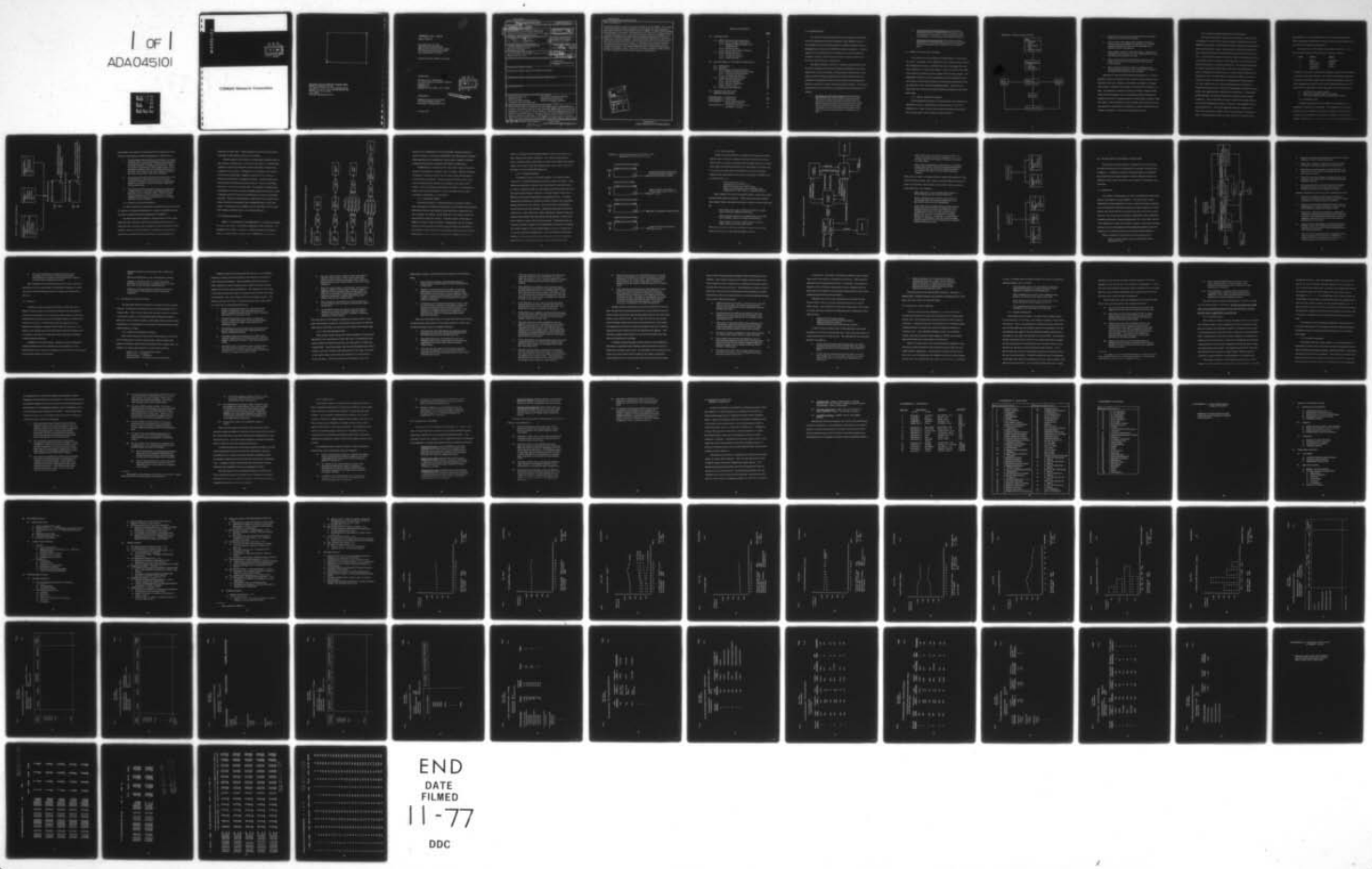

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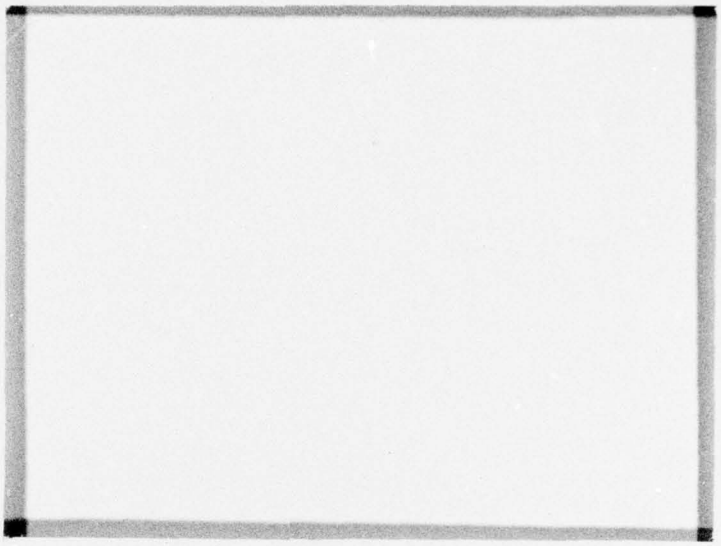

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FINAL REPORT

AN OVERVIEW OF THE PROTOTYPE INTEGRATED SIMULATION EVALUATION MODEL OF THE AIR FORCE MANPOWER AND PERSONNEL SYSTEM

Contract Number F44620-76-C-0125

Prepared for:

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The Air Force Office of Scientific Research (NL) and the Air Force Human Resource Laboratory (OR) are jointly conducting a program of research and development to provide Air Force manpower and personnel analysts with the capability to consider, in a timely and consistent fashion, second and higher order, in addition to primary, response characteristics of the Air Force Manpower and Personnel System (AF M&PS) to proposed policy implementations. The basic direction of the program is toward developing a large-scale,

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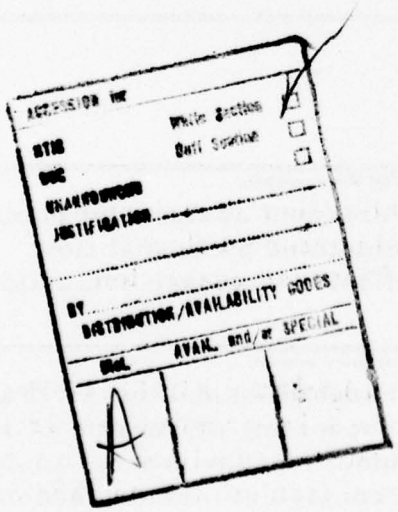
empirically based, computer simulation model of the AF M&PS. As a means of demonstrating the basic structural form and logic flow of an Integrated Simulation Evaluation Model (ISEM) of the AF M&PS, an ISEM-Prototype has been designed, constructed, and installed on the USAF CDC Computer System at Wright-Patterson AFB. The ISEM-P design is based on a modular representation of the Air Force Manpower and Personnel System in which long-range force structure planning, training program requirements, short-range personnel assignment planning, and actual personnel flows are simulated as integrated activities for the purpose of evaluating force structure response to various mission and policy changes. Current research plans call for continued evaluation of the applications and utility of ISEM through ongoing testing of the ISEM-P using "real world" scenario problems posed by actual Air Force manpower and personnel managers and analysts.



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1.0 INTRODUCTION

As a means of demonstrating the basic structural form and logic flow of an Integrated Simulation Evaluation Model (ISEM) of the Air Force Manpower and Personnel System, an ISEM-Prototype has been designed and constructed by CONSAD Research Corporation. Contract support for this development is provided by the Air Force Office of Scientific research, with technical assistance being provided by the Air Force Human Resource Laboratory.

The ISEM-P design is based on a modular representation of the Air Force Manpower and Personnel System (AFM&PS) in which long range force structure planning, training program development, short range personnel assignment planning and actual personnel flows are simulated as integrated activities for the purpose of evaluating force structure response to various mission and policy changes. In the prototype model these activities are encompassed in three simulation submodels:

1. The Aggregate Planning Submodel which accepts as input a multi-year mission plan; converts that plan into direct mission and support manpower requirements; projects the personnel force structure on the basis of expected attrition; and develops yearly plans for recruitment, training and retention which infer maintenance of the personnel force structure at the desired mission strength subject to manpower ceilings.

2. The Assignment Planning Submodel which develops short range plans for personnel flow at the base level in response to yearly plans, and in cognizance of base level manpower requirements and personnel supplies.

3. The Personnel Flow Submodel which executes assignment plans by reflecting actual movements of personnel through training and travel pipelines over simulated time.

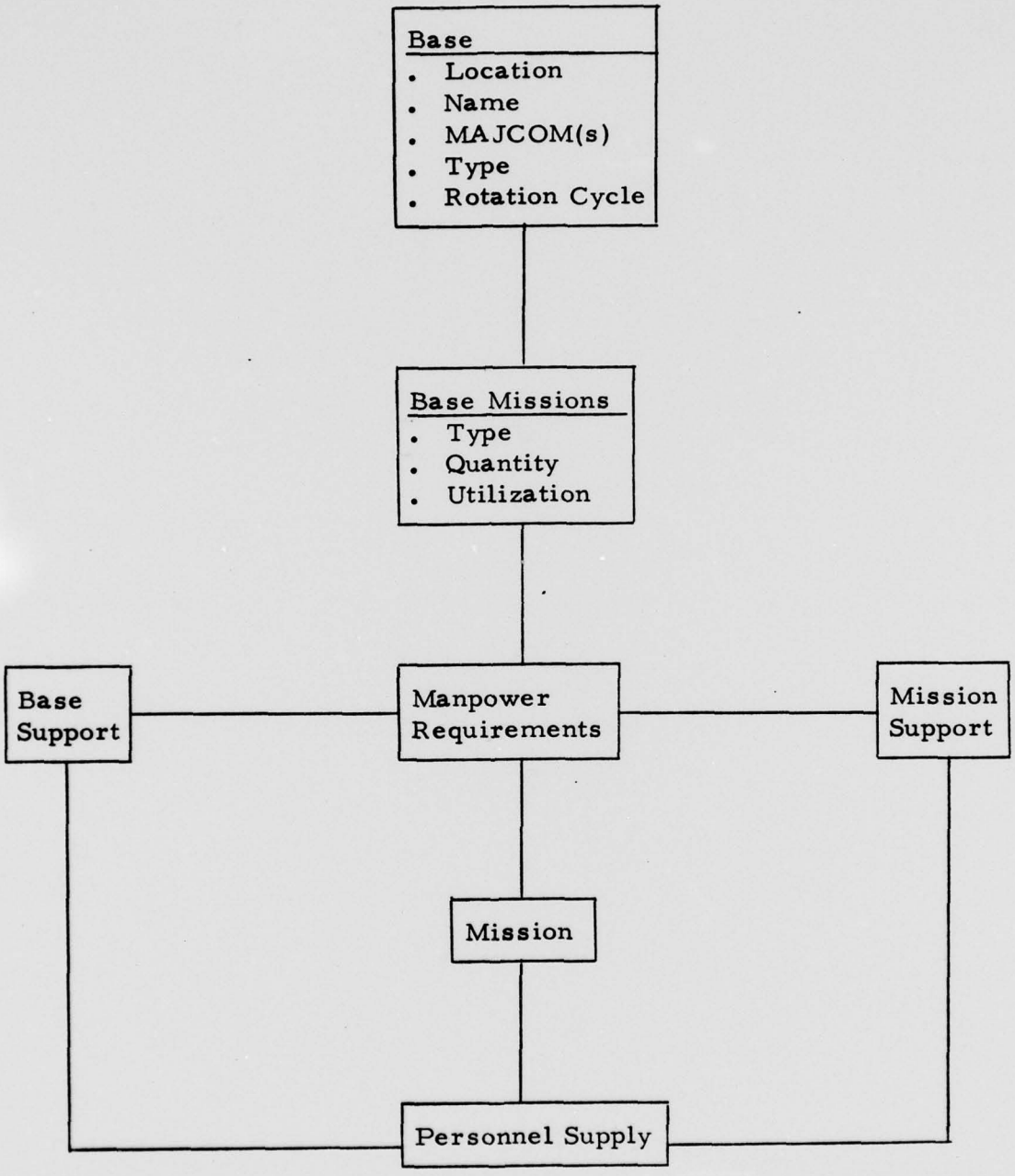
1.1 ISEM-P Concepts and Components

As is the case in any simulation modelling effort, a representation of the "real world" to be modelled must be chosen and used to form the modelling framework. In ISEM-P the real world image of the Air Force Manpower and Personnel Systems centers around the Personnel Force Structure and the Air Force Mission which it must support. The integrating of these two system components is most evident at an Air Force Base to which mission tasks are assigned and skilled personnel are attached to carry out those assignment tasks. Hence, the Air Force Base was chosen as the basic structural component of the prototype model.

1.1.1 Bases, Mission and Outputs

For demonstration purposes, seventeen bases were chosen as a reasonable scale for representing the operational Air Force (see Attachment 1). Each of these bases possess the following characteristics as attributed in the simulation model (Figure 1):

FIGURE 1: Characteristics of Bases



1. A base has a name, a location and owns some assigned mission, such as flying or training.

2. A base owns some outputs which support its mission such as an aircraft squadron producing some required amount of flying hours or a school producing some required number of graduates.

3. Every output owned by a base has a type, a quantity and a utilization rate such as two B-52 Squadrons flying forty-five hours per aircraft per month.

4. Every output requires a set of skills at various skill levels in order to be produced at the level required by the mission.

5. Every skill and skill level requires manpower in an amount dependent upon the type, quantity and utilization of outputs with which they are associated.

Missions at a base and their associated outputs are, of course, variable to allow for changes in force mission or force structure configuration over time. Outputs can be added, eliminated or changed with respect to utilization according to any desired time trajectory or plan. As missions or outputs at a base are altered, required skills, skill levels and manpower are corrspondingly added, eliminated or adjusted according to standard manpower relationships contained within the model. These standards are also variable to the extent that users may specify new parameters or equations to reflect technological innovations or changes in management engineering policies.

1.1.2 Manpower Skill and Skill Level Classification

The basic accounting of manpower requirements and the personnel supplies which fill them is done according to skill type and level of expertise in the skill. A skill type describes a function to be performed and is associated with either a requirement to perform that function or with a group of personnel who possess the ability to perform that function. A skill level describes the amount of experience/training required in the performance of a function or the experience level possessed by a group of personnel in a particular skill type. The prototype model has 51 Airman skill types and 49 Officer skill types (see Attachment 2). These correspond, for the most part, to actual skill descriptions contained in the Air Force Specialty Classifications (AFSC). In order to reduce the number of skill types to a manageable yet representative set, those skills which are relatively homogeneous with respect to function performed and less sensitive to fluctuations in mission requirements, were aggregated to a general career field level. These aggregated skill types are mostly in the base or indirect mission support categories. Other skills which are more sensitive to mission fluctuation yet still homogeneous relative to function, were aggregated to the career group level. These mid-aggregate skills are mostly in the direct mission support category such as air operations or communications. Remaining skills which are most sensitive to mission changes

and output type were classified at the more detailed specialty level. These disaggregate skill types are mostly in the mission category such as aircrew or maintenance (Figure 2).

Each skill type in the model is stratified by skill level. There are five skill levels for airmen and four levels for officers:

Level	Airmen	Officer
1	Helper	Lieutenant
2	Apprentice	Captain
3	Journeyman	Major
4	Technician	Colonel
5	Supervisor	

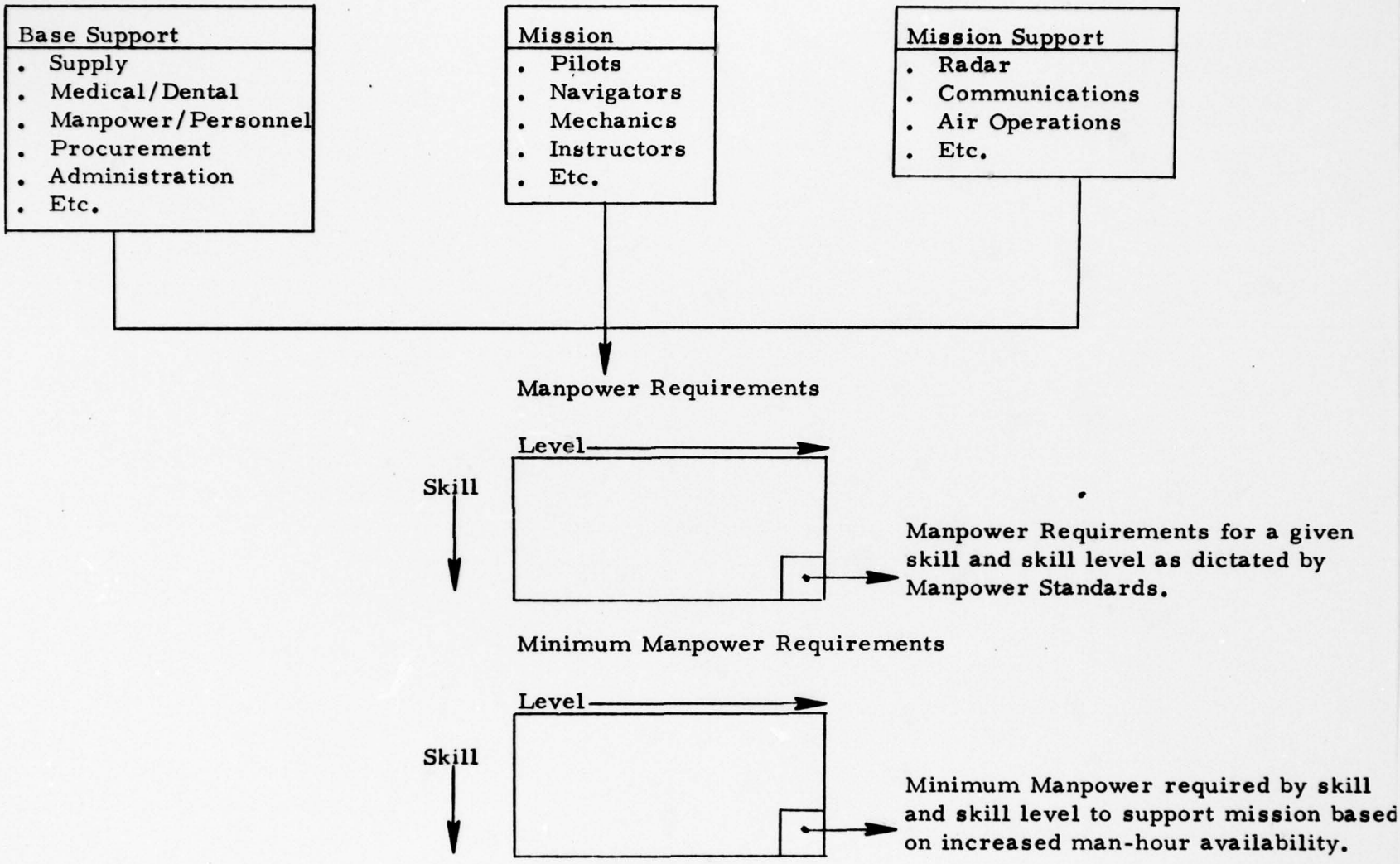
In addition to the basic accounting of manpower requirements and skilled personnel by skill and skill level, the model also maintains additional memories of personnel supply for planning and management purposes. These supplemental memories each add an additional dimension to the skill and level stratification and the principle ones are listed below:

1. Air Force Incumbency (years)
2. Skill Level Upgrade Eligibility (months)
3. Overseas Assignment Return Eligibility (months)

1.1.3 Simulated Time

The basic increment of time in ISEM-P is considered to be equivalent to real time of one month. The simulation of events and activities such as personnel movements, planning, projection, and training are all scheduled on the basis of multiples or fractions of months. Specifically, the three main submodels discussed in Section 1.1

FIGURE 2: Manpower Requirements



all simulate some aspect of manpower/personnel planning or force structure state change at different aggregates of monthly time:

1. The Aggregate Planning Submodel functions on a twelve month or yearly cycle in developing system-wide plans for manpower requirements, personnel authorization, personnel training, recruitment and attrition. There is no limit to the number of yearly plans which can be generated, however, they are normally developed on a five year cycle with the base year changing to reflect the most current state of the force structure.

2. The Assignment Planning Submodel functions on a nine month assignment planning horizon in scheduling personnel movements, Air Force entry, training and attrition according to monthly objectives established by the yearly plans.

3. The Personnel Flow Submodel functions on a discrete monthly basis for execution of assignment plans and reporting of force structure state. Discrete events such as training or travel completion are, however, scheduled on the basis of month fractions, if training and travel times so dictate.

1.1.4 Travel and Training Pipelines

In order to effectively simulate and evaluate the flow of personnel in response to assignment planning, the concept of a pipeline network is used to represent travel and training flows in ISEM-P.

Uni-directional travel pipelines connect all bases in the model. Each base pair, therefore, has two connecting travel pipes each of which may have a unique mode of transport, travel time and/or travel capacity. Status of a travel pipeline is indicated by its current personnel volume stratified by skill, skill level, travel purpose and

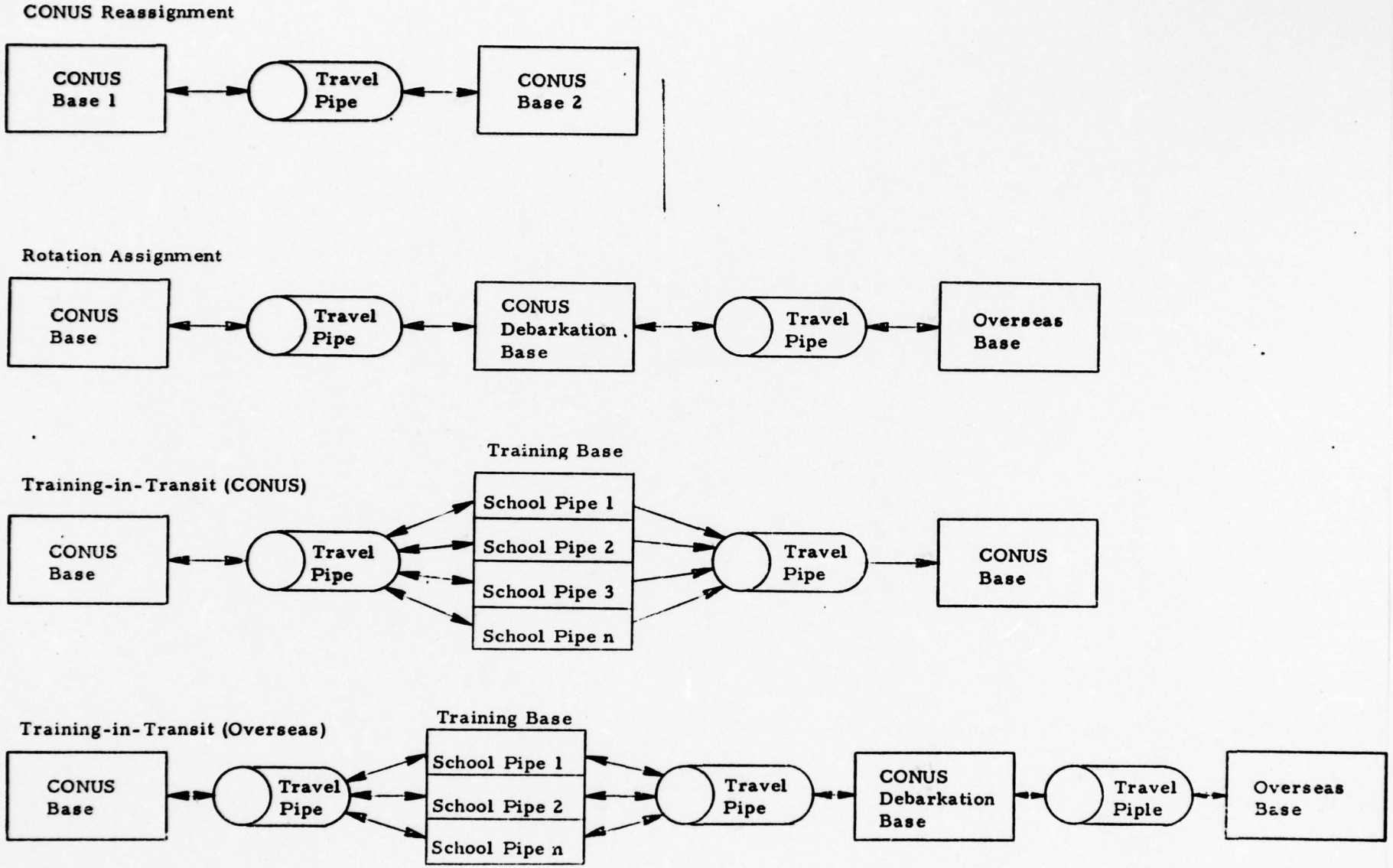
destination arrival time. These pipelines are used to flow personnel from base to base and account for time in travel.

Training pipelines are similar to travel pipes except that entry to and exit from training pipes occurs at the same base. A training pipe resides at a base and represents a school which has a training time, a capacity and a purpose. Training time is equivalent to the duration of the course being taught. Capacity is dictated by the number of instructors and amount of equipment available. Purpose dictates the result obtained by graduation from the school, such as an upgrading from level 1 to level 3 in a given skill. The number of training pipes is dictated by the number of unique training purposes and they are used to change the skill or skill level classification of a group of personnel over time. Status of a training pipe is indicated by its current trainee volume stratified by graduation time and pending skill or skill level award. Training and travel pipelines can be used end-to-end to represent training-in-transit policy, if so desired (Figure 3).

1.2 Programming Approach

ISEM-P is programmed in the SIMSCRIPT II.5 simulation language for use on Air Force, Control Data Corporation (CDC) equipment. An appendix to this report, containing a complete listing of the program code, is available under separate cover. SIMSCRIPT was selected

FIGURE 3: Role of Pipelines in the Assignment/Training Process



because of its compatibility with the entity/flow concepts outlined in earlier sections, its interface compatibility with other popular programming languages and its adaptability to most major computer hardware systems including USAF Honeywell and UNIVAC installations.

In SIMSCRIPT components of the "real world" system being simulated are represented as entities, sets, or events. Entities represent permanent or temporary objects in the system whose characteristics are described by attributes. Events represent activities which occur over simulated time and usually cause changes in the state-of-the-system. Sets are ordered accumulations of entities or events and are used to associate those entities or events with each other to reflect ownership, commonality, or a hierarchy.

1.2.1 Permanent Entities

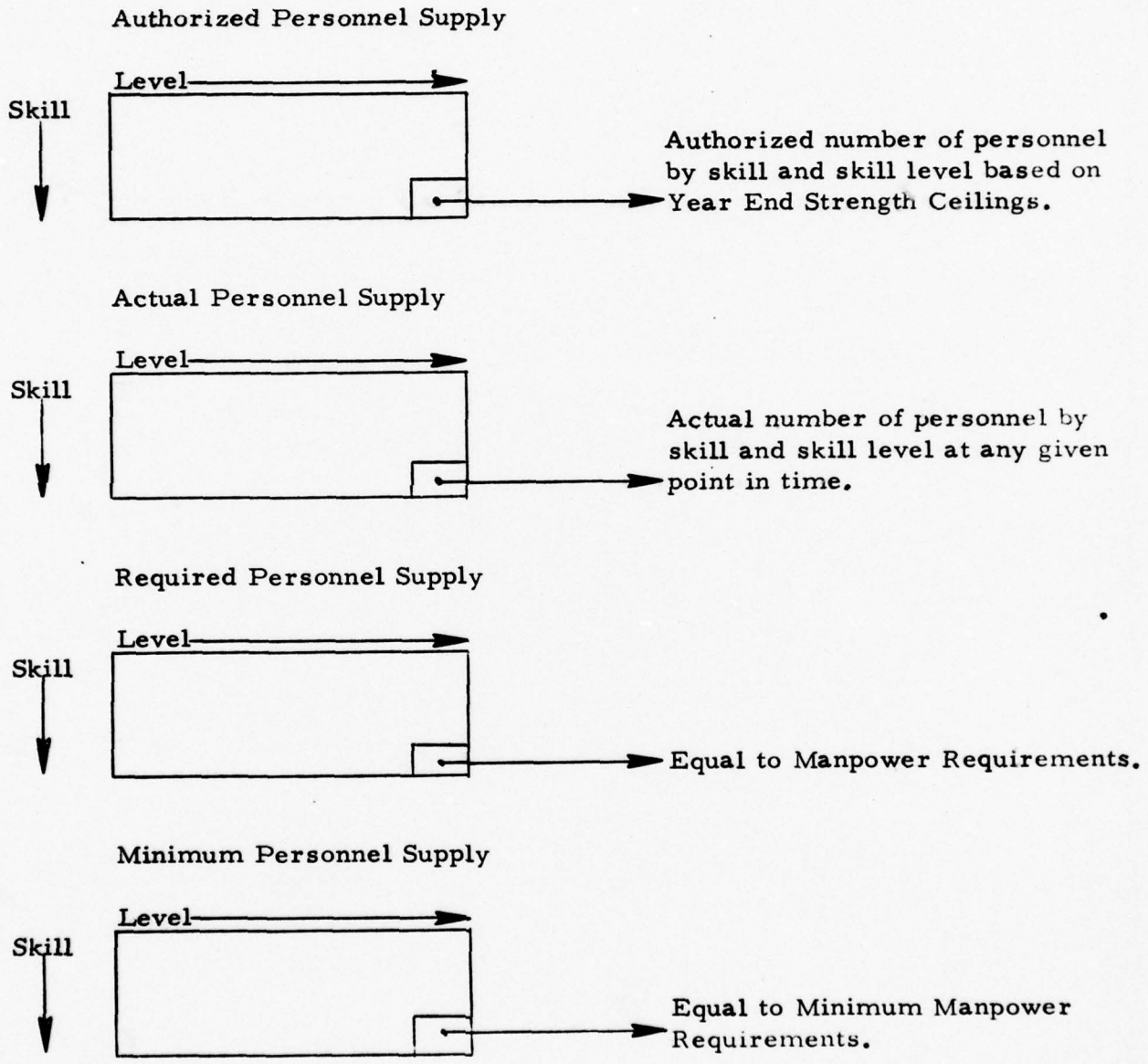
As the name implies, a permanent entity represents an object with a permanence of definition and function in the system being modelled. While the attributes which describe these objects are themselves subject to change, the entities, for the most part, are neither created nor destroyed from within the system. Principle entities of this type in ISEM-P are bases, skills, missions, training pipes, and travel pipes. Creation of these permanent entities does not destroy the flexibility of the model but rather enhances it by providing a fixed framework against which changes can be reflected. Consider the following example. A

skill is a permanent entity because skills are always required to produce outputs which support missions. Yet a skill is described by a type, a required supply of personnel, an authorized supply and an actual supply, all of which reflect the changing state of the system relative to the fixed reference called skill (Figure 4).

1.2.2 Temporary Entities

A temporary entity, as its name implies, is a transient object which can be created and destroyed within the system as needed. These entities are generally created to store and transfer information about a current or pending change in system state and are then destroyed when that system state change is effected. Principal entities of this type in ISEM-P are personnel assignments and planning periods. Personnel assignments (ABLKS) are temporary entities created to flow personnel groups into the Air Force (entry), out of the Air Force (separation), among bases and through training. ABLKS have descriptive attributes such as size, skill, skill level, origin, destination, departure date and purpose which dictate their flow and the timing and type of change they are to reflect in system (force structure) state. Planning periods are temporary entities created to store information on projected or planned force state changes in a time ordered manner for use in creating and/or executing personnel assignments. These periods have descriptive attributes such as projected personnel supplies, authorized supplies, planned training, planned assignments and expected separations.

FIGURE 4: Personnel Supply (Given by Base, Year, Month and/or Total for Air Force)



1.2.3 Events and Sets

Events are used in ISEM-P to schedule the occurrence of some activity which results in a change in the state of the force structure. These events are usually associated with a planning period or an exogenous input and contain instructions as to what change in system state is to occur at the time period with which the event is associated. Typical events which guide the basic flow of personnel in ISEM-P are as follows (Figure 5):

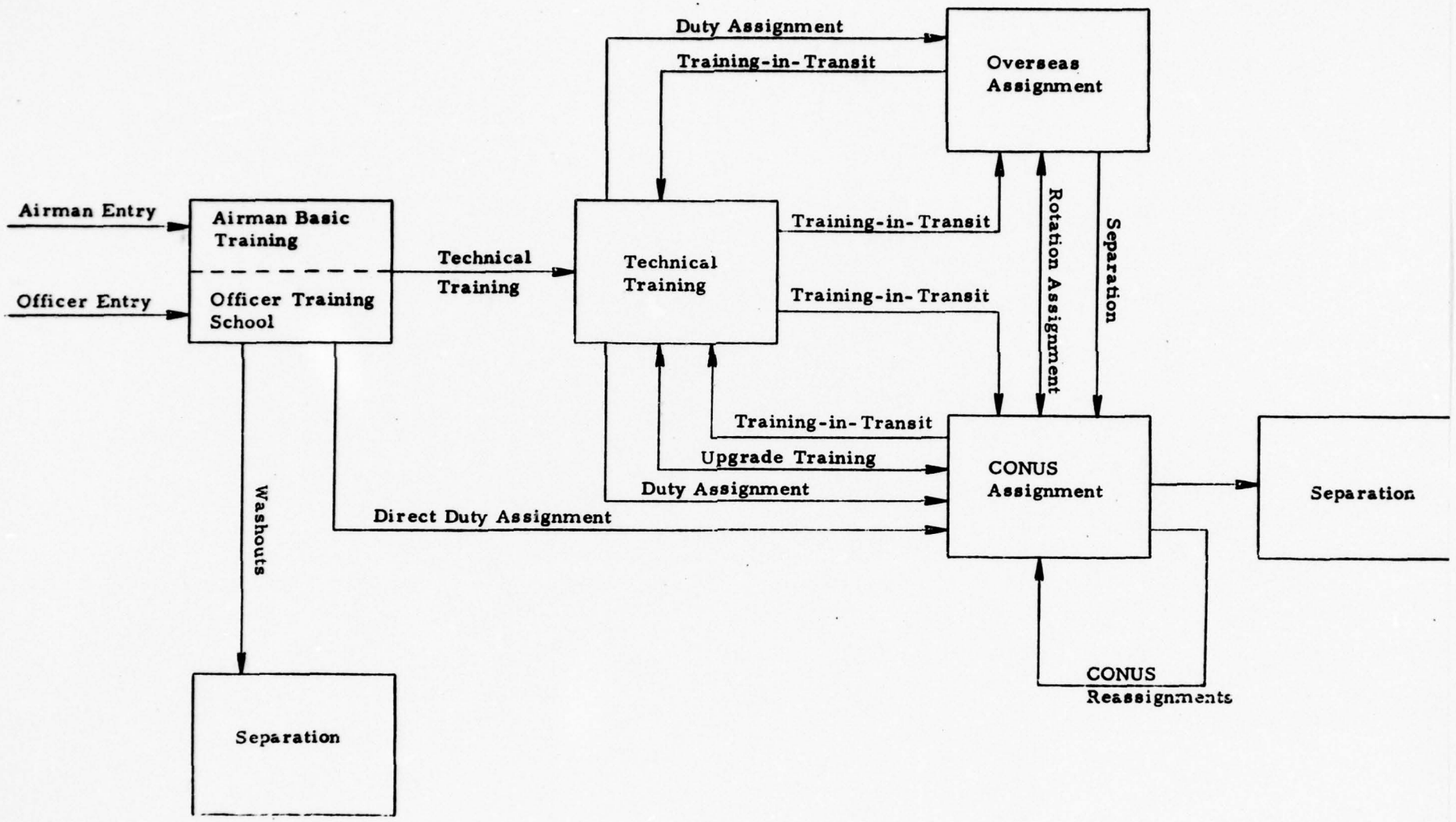
- Entry into the Air Force
- Separation from the Air Force
- Entry to and Exit from Travel Pipes
- Entry to and Graduation from Training Pipes
- Adjustments to Year Plans or Assignment Plans

Sets in ISEM-P are used to associate entities, rank order events and accumulate delay information. When used to associate entities they usually reflect ownership of one type of entity by another type such as:

- Every base owns a set of missions which is a simple list of missions assigned to that base.
- Every mission owns a set of outputs which is a simple list of outputs required to support that mission.
- Every output owns a set of skills which is a list of skills required to produce that output.

When sets are used to reflect the ordering of events, they usually associate entities in a time-ordered manner such as:

FIGURE 5: Basic Physical Flow of Personnel



- Every base owns a set of planning periods which is a list of planning periods in accordance with the order of time in which some change in the state of the base is to take place.

- Every base and planning period owns a set of planned assignments which is a list of personnel assignments to be effected at that base during that time period according to the order of time in which they were created.

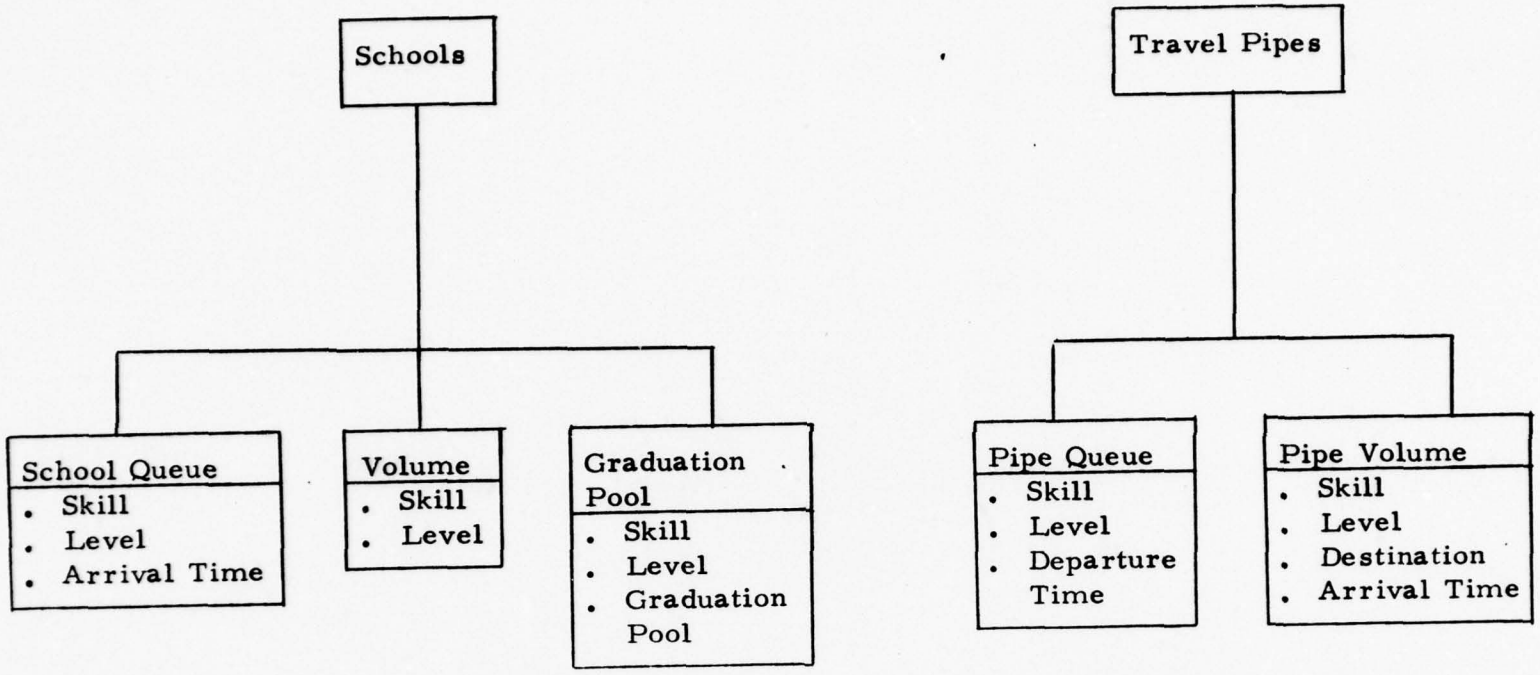
When sets are used to accumulate delay or status information for transient personnel supplies, they usually associate entities by means of a queue or in-process volume which is serviced at a given rate by an event (Figure 6). For example:

- Some bases own a set of training pipes which is a list of training schools present at that base.

- Every training pipe has an entry queue which is a set through which all training assignments must pass before entry into the training pipe.

- Every entry queue contains some personnel assignments in the form of a list of assignments to the training school ordered by time of arrival at the training base which is serviced by Event Enter School until the queue is dissipated or training capacity is reached. If capacity is reached before the queue is dissipated, then non-serviced assignments maintain their queue position and are delayed until the next entry event.

FIGURE 6: Transient Personnel Supplies



2.0 AN OVERVIEW OF THE ISEM-P STRUCTURE

The general submodel structure of ISEM-P has been discussed in earlier sections and is now presented in a stylized, flowchart form in Figure 7. In addition to the three main submodels, the flowchart also indicates the principle program routines contained in those submodels as well as their interactions with scenarios, initialization and reporting.

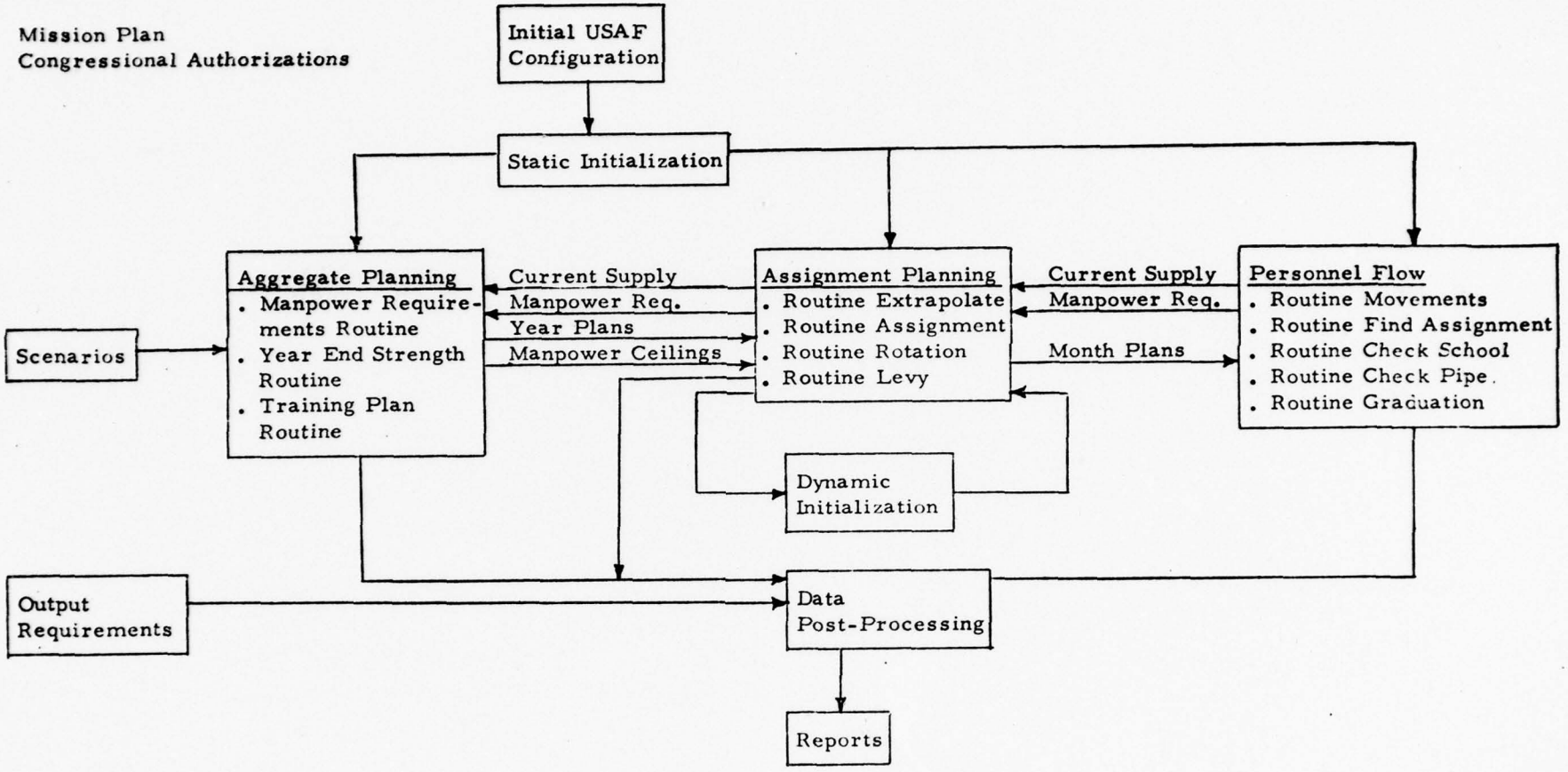
2.1 Initialization

Two modes of initialization are used to establish the initial condition for a simulation run using ISEM-P. The first mode is static initialization which establishes the base, mission and output configuration, the manpower requirements and the personnel supplies at a fixed point in time which will become month one of year one for the simulation run. The second mode is dynamic initialization which establishes training requirements, planned assignments, Air Force Entry and Air Force Separation at least nine months in advance of the static initialization time so as to encompass the first assignment planning cycle and initialize such transient entities as travel and training pipelines.

Static initialization will perform the following functions:

1. Read in all data tables used for initialization and/or operational runs.

FIGURE 7: Basic Structure and Flow of ISEM-P



2. Execute the Manpower Requirements Routine for initial conditions of base mission and output.

3. Equate base manpower requirements to base supply to initialize personnel supplies by skill and level.

4. Distribute personnel supplies by skill and level over years of Air Force tenure to initialize the Air Force incumbency memory.

5. Distribute personnel supplies by skill and level over months of skill level tenure to initialize the upgrade eligibility memory.

6. For overseas bases, distribute personnel supplies by skill and level over months of base tenure to initialize overseas return eligibility memory.

Dynamic initialization will carry out the following functions:

1. Execute the Manpower Requirements Routine for years one's sending values of base mission and output if different from initial mission conditions.

2. Execute the Year End Strength Routine for year one ending values of airman and officer ceilings to establish manpower ceilings by skill and level.

3. Execute the Training Plan Routine for established manpower ceilings and projected attrition to the end of year one and establish a monthly plan of training upgrades, desired Air Force entry and expected separations for each base.

4. Execute Routine Extrapolate, Routine Rotation and Routine Levy for the established monthly plans at each base to determine the required assignments in each month of year one.

5. Execute Routine Assignment for established assignment requirements at each base to establish a planned schedule of assignments at each base, for each planning period (month) in year one.

6. For those assignments scheduled in periods prior to month one of year one, execute the Personnel Flow Submodel to initialize training and travel volumes up to the static initialization period.

Upon completion of the initialization process a full, multi-year simulation run can be made based on established conditions in month one of year one and scheduled events for months one through nine of year one.

2.2 Scenarios

The basic scenario required to generate a multi-year run of ISEM-P consists simply of a multi-year trajectory of congressional manpower authorizations and a multi-year mission plan for each base. Authorizations are input as year end strength ceilings for officers and airmen for each year. Mission plans need only specify the type, quantity and utilization of outputs at each base, for each year. If so desired, only starting (year one) authorization and mission plans need be specified with values for subsequent years being input as changes to those starting conditions.

In addition to the basic format, changes to several model parameters and data sets can be effected in a cross-sectional or time-phased manner by the inclusion of exogenous event notices in the scenario. Such optional changes could include:

- Mandated ceilings for a particular skill or skill level group.
- Mid-year adjustments to year end manpower ceilings.
- Changes in retention rates for a particular skill, skill level or year group, or a blanket change in retention rates for all personnel classifications.
- Changes in training standards reflected by increases or decreases in training times and/or equipment utilization.

2.3 The Aggregate Planning Submodel

The Aggregate Planning Submodel is composed of three principle routines: (1) Manpower Requirements; (2) Year End Strength; and (3) Training Plan. These three routines are executed in series to convert a multi-year scenario of congressional authorizations and mission plans into a set of month-by-month, yearly plans whose execution infers maintainance of the personnel force structure at desired mission levels within manpower ceilings.

2.3.1 Manpower Requirements Routine

This routine accepts as input yearly mission plans for each base in the model given in terms of mission type, required output type, quantity of standard output units and utilization rate of output units. An example of a mission specification for a given base would be:

Mission Type = Tactical Fighter Support
Output Type = F-4 Squadron
Output Quantity = 3 Squadrons
Utilization Rate = 25 Flying Hours/Aircraft/Month

Contained within the Requirements Routine are a set of standard manpower equations which are based for the most part on actual Air Force Manpower Standards. These standards indicate the types of skills required at a base to provide direct, indirect and base mission support for the given output specification. The equations are also used to calculate the required number of manpower slots for each skill based on the quantity, type, and utilization rate of the assigned outputs. The following example will serve to illustrate the logic flow of this routine for a base with an assigned flying mission:

1. Based on specified flying hours, aircraft type and number of squadrons, total base flying hours are used to calculate the requirement for pilot, navigation and squadron air operation skills.

2. Total base flying hours are used to calculate the number of flight plans which is used to calculate the requirement for air traffic control and base air operations skills.

3. Total flying hours per aircraft type are used to calculate the requirement for field, organizational and various maintenance skills.

4. A standard equipment configuration is used to determine the requirement for communications, radar and weather equipment operation, repair and maintenance skills.

5. The total number of aircraft by type is used to calculate total munitions which is used to calculate the requirement for munition loading storage and handling as well as weapons maintenance skills.

6. The sum of all required mission, direct and indirect mission support skills, is then used to iteratively solve a set of simultaneous equations which relate the requirements for base support skills to the size of base population.

7. When the requirements for all mission, direct mission support, indirect mission support and base support skills have been calculated, they are distributed over skill levels according to distribution specified by the manpower standards or typical distributions used system-wide for base support skills.

8. Base manpower requirements by skill and skill level are then entered into a manpower requirements matrix for the base.

9. An equivalent manpower matrix is also generated to reflect the minimum (threshold) manpower requirements for each skill and level, necessary to maintain production of base outputs.

The end product of the Manpower Requirement Routine will be a manpower and minimum manpower requirements matrix given by skill and skill level for each base, for each year in the multi-year mission plan.

2.3.2 Year End Strength Routine

This routine accepts as input the mission manpower requirements generated in the requirements routine and a set of Congressional manpower ceilings for officers and airmen, for each year in a multi-year scenario plan. Given these inputs, the Year End Strength Routine determining a year end ceiling for each skill and level, for each year based on the relative total requirements for manpower in a skill and level across all bases. The basic algorithm for allocating a year end

authorization ceiling to each skill and level consists of the following steps:

1. Sum minimum manpower and standard manpower requirements across all bases for each skill and level in each year.

2. Allocate to each skill and level a share of the total authorization equal to their minimum requirements. If the total is not sufficient to cover minimums, then a report is generated which details the degree of below minimum manning and a user adjustment to requirements is requested.

3. If minimums are met and authorizations remain, then the amount above minimum is allocated to skills and levels in proportion to their respective ratios of minimum to standard manpower requirements. This allocation is a default which can be replaced by an input priority scheme for allocating authorization above the minimum.

Since year end authorization for a given skill and level must also include training authorizations in that skill and level in a given year, the above algorithm must be modified as follows:

1. The total year end authorization for mission requirements becomes the total year end authorization less the authorized amount in training that year.

2. Each skill and level is then allocated a year end strength equal to their requirements share times the total authorization less some unknown training authorization.

3. Given the starting supply of personnel by skill and level for this planning cycle, a projected supply is calculated using expected attrition rates for each skill, level and year group.

1. Using the projected year end supplies and authorized year end strength for the highest level of a given skill, the positive, zero or negative difference between year end authorization and projected supply is calculated.

2. If the difference is negative, then projected supply exceeds authorization and the training requirement for the skill and level is set to zero for that year. In the case of an expected supply surplus, the retention rate (1 - attritions rate) is adjusted downward for the skill and level in the surplus year to dissipate the expected average by the year's end.

3. If the difference is zero, then the projected supply equal authorization and the training requirement for the skill and level is set to zero for that year. No adjustment is made to retention in this case.

4. If the difference is negative, then the projected supply is less than authorization and the training requirement for the skill and level is set equal to the size of the negative difference for that year.

5. This three-way test is then repeated for the next highest level in the same skill with one logic change. The projected supply for the next highest level is reduced by an amount equal to the non-zero training requirement for the highest level. This assures that losses due to training upgrades will be accounted for in establishing training requirements for each subsequent level in a given skill.

6. Three calculations are repeated from supervision down to apprentice level for each year and airman skill; and from Colonel down to Lieutenant level for each year and officer skill.

7. When the training requirement has been calculated for each skill and level in each year, it is allocated over each month in a year according to the distribution of separation over those months. This distribution was selected since attrition is the main determinant of training requirements for a given mission.

8. Expected separations for each skill and level in a given year are distributed over months according to a typical distribution of Air Force entry. This distribution was selected since the month of separation is generally determined by the month of entry plus the term of enlistment.

9. After training requirements have been allocated to each month of a multi-year plan for each skill and level, the requirement is split into training to be conducted on the job (OJT) and training to be conducted by formal technical schools. This split is accomplished by means of a policy variable dictating the OJT/Formal School ratio for each skill and level upgrade. This split is, of course, constrained by the total authorization.

Monthly training requirements must next be adjusted for the fact that a formal school training requirement for a given skill and level in a given month will increase the training requirement for the next lowest level in some earlier month. This results from the fact that formal school training requires the removal of personnel from a base supply for assignment to school at a time period equal to the time of training requirement less training time for the required level upgrade. This will cause unfilled requirements for the lower level skill which must be accommodated for by training.

A similar training lag effect is also present in the calculation of the helper to apprentice level training requirement and the recruit to helper level training requirement. The apprentice level training requirement in any given month must be lagged by the helper to apprentice level training time for a given skill to determine the required monthly

entry of basic training graduates (helper levels) into apprentice level training. This monthly requirement for helper level personnel must then be lagged by basic training time to calculate the monthly requirement for entry into the Air Force. The adjustment of training requirements due to formal school training lags and the calculation of helper level and Air Force entry requirements are both accomplished through the use of the following algorithm:

1. Starting with the first month, in the first year, for each level in a given skill, the training time for formal school to the next highest level is established from the training time table.

2. The formal school training requirement for the next highest level is then read for the period equal to the current period plus training time for upgrade to that next highest level.

3. The amount of required formal school training in the "look ahead" month then becomes the amount which must be assigned to school training from the supply of the given level personnel in the current month.

4. The above process is repeated for each skill and level, for every month of each year in a multi-year plan.

5. The monthly requirements calculated for entry of basic training graduates (helper level) into apprentice level school becomes the required lagged disposition scheme of helper level personnel at the exit end of the basic training pipe.

6. The total of the helper level monthly requirements over all skills becomes the total lagged requirement for entry into the Air Force.

In reality the "look ahead" calculation conducted in step 2 above may involve more than one training time increment. When adjusting apprentice level training requirements, for example, the adjustment depends on the journeyman requirement in some subsequent period which will in turn depend on the technician requirement in some subsequent period beyond the first look ahead.

Examples used in the above discussion were geared towards airman skills, however, the same adjustment process is used for officer skills. Upon completion of the above listed steps, every month in a multi-year plan will have the following values calculated for each skill and level:

- Required OJT Training (inflow)
- Required Formal School Training (inflow)
- Planned Separation (outflow)
- Required Formal School Assignments (outflow)

A share of these monthly values is then allocated to each base according to each base's proportional share of the total authorization for a given skill and level in a given year. The rationale for this allocation process is as follows:

1. A base with the greatest proportional share of a skill and level authorization will in general have the greatest proportional share of the total supply of that skill and level.

2. A base with the greatest proportional share of a skill level supply will, on the average, realize the greatest proportional share of skill and level separation in a given year.

3. Since separations are the major determinant of training requirements, a base with the greatest proportional share of separation from a skill and level in a given year would require the largest proportional share of planned training into that skill and level in that given year.

The end product of the Training Plan Routine is, therefore, a shared value of monthly training requirements and separations for each base, for every month in a multi-year plan.

2.4 Assignment Planning Submodel

The basic function of this submodel is to convert the planned training requirements and separations developed in the Training Plan Routine into a set of planned personnel movements for each month at each base. A secondary function of the submodel is to develop monthly assignment plans to maintain the required assignment rotations at overseas bases. All assignment planning is based on a month-by-month, recursive projection of base supplies, with the horizon planning month being nine months ahead of current time.

Prior to a discussion of each routine within this submodel, some discussion of data available to and associated with each base for each month would be appropriate. As discussed in earlier sections every base owns a set of planning periods (months) and each of these planning periods has some monthly data associated with it by means of attributes

or sets. Principle data associated with these periods for assignment planning purposes are as follows:

- Every planning period has some planned separation, required OJT upgrades, required technical school upgrades and planned school assignments.
- Every planning period owns a set of pending assignments out of the personnel supply at the base.
- Every planning period owns a set of pending assignments into the personnel supply at the base.
- Every planning period has an authorized year end strength for each skill and level at the base.

2.4.1 Routine Extrapolate

The purpose of this routine is to project the personnel supply by skill and level, at each base, nine months in advance of the current time period. This is accomplished by using the projected ending supply of month eight (the ninth month of the previous planning cycle) and incrementing that supply by the net difference between planned inflow and outflows associated with the ninth or horizon month. An additional function performed by this routine is to compare the projected supply for the current horizon month with the year end authorization by skill and level for the year in which the horizon month resides. This is done to determine if the current supply trajectory is targetted toward the year end authorization. It should be noted here that the aggregate, yearly plans only inferred a targeting of total year end strength by skill and level across all bases. It is therefore still possible that a supply

imbalance could exist among bases with the surpluses and deficits netting out to the desired year end strength in the aggregate. It is for this reason that Routine Extrapolate seeks to identify base level supply deficits so that remedial assignment action can be taken to correct a skill and level supply imbalance among bases.

The following logic steps are employed within Routine Extrapolate to carry out its projection and comparison function:

(1) For each skill and level determine the month ending supply for period equal to horizon period minus one.

(2) Add to that skill and level supply the OJT Training Requirement, Required Formal Training and any pending assignments into the given skill and level associated with the horizon month.

(3) Subtract from the total calculated in Step 2, the Planned Separations, Required Formal School Assignments, Required OJT Training for the given skill level plus one, and any pending assignments out of the given skill and level associated with the horizon month. The result of this subtraction becomes the projected supply for a given skill and level for the horizon month.

(4) Subtract the value of year end authorization for the given skill and level associated with the horizon month* from the projected skill and level supply for the horizon month.

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* A monthly skill and level authorization may differ from the year end authorization if a scenario has dictated a monthly phase-out or phase-in of a mission or output at a base.

(5) If the calculated difference is positive or zero, then a supply surplus or exact targeting exists relative to authorizations and no additional assignment action is required.

(6) If the difference is negative then a supply deficit is expected and a skill level demand equal to the difference is associated with the base and horizon month for use by the assignment routine.

The end products of Routine Extrapolate are a projected supply for each skill and level, at each base, for the current horizon month and a set of assignment demands for each skill and level, at each base for which a supply deficit was projected.

2.4.2 Routine Rotation

This routine is simply a memory mechanism which is associated with all bases where a set of assignment actions are required to take place according to an established schedule. Principally this memory is associated with overseas bases where a fixed tour of duty mandates that a certain portion of the skill and level supply be reassigned each month to a non-overseas base. This in turn establishes an equivalent requirement for skill and level assignments into the personnel supply at overseas bases each month. This memory may also be associated with any base where mission or output changes mandate a specific schedule of supply reduction or augmentations on a monthly basis.

The rotation memories are maintained by skill and level and contain as many time period (month) cells as are required by the fixed

assignment schedule. If the reassignment schedule for an overseas base is 12, 18 or 24 months, then the rotation memory contains 12, 18 or 24 time cells respectively. Each time cell contains the fraction of the skill and level personnel supply at the base which must be reassigned 1, 2, 3, ... or 12 months from the current time period. As personnel arrive at these overseas bases they are assigned to the last cell in the rotation memory for the current rotation cycle. If these memories are used to reflect concurrent or discrete drawdowns and build-ups of different skills then the mechanism is similar to that of overseas assignment cycles except that usually only one cycle is used.

The purpose of these mandated assignment cycle memories is to provide information to the Assignment Routine regarding required assignment actions so that personnel movements can be scheduled accordingly.

2.4.3 Routine Assignment

The primary function of this routine is to set up schedules for personnel movements over time which will satisfy assignment requirements mandated by training schedules, rotation memories, separations and projected skill and level demands. This function is performed for each skill and level at every base for the horizon month. In general, the assignment algorithm assesses the assignment in and assignment

out requirements at each base (including training bases); creates assignment blocks (ABLKS) for assignments out and schedules them in the pending assignment out set for the given base and planning period; and schedules a corresponding assignment into the assignment in set of the destination base indicated for the ABLK. The following steps indicate the basic order of the logic used to set up and schedule personnel movements in Routine Assignment:

(1) For every base having a Required Formal School Training (inflow) in the horizon month, create an ABLK to schedule the required number of skill and level personnel to be moved from the training base to the requirement base in the horizon month. Place these ABLKS in the graduation disposition set for the appropriate training pipe at the appropriate training base in the horizon month.

(2) For every base having Required Formal School Assignments (outflow) in the horizon month, create an ABLK to schedule the required number of skill and level personnel to be moved from the requirement base to the appropriate training base. Place these ABLKS in the pending assignment out set for the requirement base in the horizon month.

(3) For required assignments of helper level personnel from basic training graduation to apprentice level schools in the horizon month, create ABLKS to schedule the required number of personnel to be moved from the basic training base to the appropriate training base. Place these ABLKS in the graduate disposition set for the basic training base in the horizon month.

(4) For required entry of personnel into the Air Force, create an ABLK to schedule the required number to be entered into basic training. Place these ABLKS in the assignment pending in set for the basic training base in the horizon month.

(5) For each ABLK created in steps 1-4 to move personnel into training pipes, create an equivalent ABLK and place it in the graduation pool set for the training pipe at a time period equal to school entry period plus training time. ABLKS placed in graduation pools should be changed to reflect the new skill or skill level obtained by training.

(6) For each ABLK created in steps 1-4 to move personnel from training bases to requirement bases, create an equivalent ABLK and place it in the assignment pending in set for the destination base.

(7) For every base with pending assignments out created in steps 1-4, reserve that fraction of skill and level supply designated for assignment action.

(8) For every base with a demand for assignment due to supply deficits or rotation requirements in the horizon month, perform the following:

(a) Check that fraction of training pipe graduation pools for which assignment disposition are not present to determine if required number of skill and level personnel will be available;

(b) Check rotation memories at bases other than the requirement base* to determine if the required number of skill and level personnel are available;

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*If assignment requirement exists at an overseas base, assignments from other overseas bases are not allowed.

(c) If sufficient supplies cannot be found in steps (a) and (b), then transfer the assignment requirement to the Levy Routine.

(9) If an appropriate personnel supply is found to meet the assignment requirements, then create an ABLK to schedule the movement of the required number of skill and level personnel from the designated supply base to the requirement base. Place these ABLKS in the appropriate pending assignment out or graduation disposition sets at the supply bases in the appropriate time period.

(10) Repeat steps 6 and 7 for all ABLKS created in step 9.

When executing steps 8(a) and 8(b), the time period used to determine supply availability is that period equal to the period at which the requirement exists less travel time from the supplying base to the requirement base. This infers that movements will begin sufficiently early to insure arrival in the required time period.

It should be noted that all personnel supplies available for assignment (training and rotation) which are not committed in any given assignment cycle, remain associated with their availability period for possible assignment up until current time equals their availability time. If supplies remain uncommitted until current time, then the Personnel Flow Submodel creates an assignment for them.

The end products of the Assignment Routine are therefore all those scheduled personnel movements placed in pending assignment, graduation disposition or graduation pool sets at each base for every assignment planning period (horizon month).

2.4.4 Routine Levy

This routine receives as input from the Assignment Routine all those assignment requirements in the horizon month for which assignments could not be created from available, uncommitted personnel supplies. Upon receipt of assignment requirements, this routine searches all bases for supply surpluses in the required skill and level. These surpluses are identified in a manner similar to that used to identify supply deficits in Routine Extrapolate. The appropriate time period for identifying supply surpluses is calculated to allow for required travel as in Routine Assignment and the same restrictions regarding reassignments among overseas bases apply to Routine Levy as well.

In identifying supply surpluses at bases to meet assignment requirements the following logic steps are employed:

(1) For the required skill and level, compare the extrapolated, non-assignment reserved supply at each base in the appropriate time period with the authorized supply for that period.

(2) If a surplus in the required amount exists, then transmit the appropriate supply, origin base, destination base and time period information back to Routine Assignment for creation and scheduling of required ABLKS.

(3) If surpluses are insufficient to meet requirements at any one base, then several bases may be used to accommodate one requirement.

(4) If surpluses over all bases are insufficient to meet requirements, then the requirements are carried over to the next assignment cycle.

(5) ABLKS created as a result of Routine Levy are assigned a LEVY code for their purpose attribute and a subject to cancellation up until current time if excess supplies or additional surpluses are identified prior to that time.

2.5 Personnel Flow Submodel

The purpose of the submodel is to cause physical changes in the state of the personnel force structure by executing planned personnel movements scheduled by the Assignment Planning Submodel. Five principle routines are contained in this submodel and they are executed in an integrated, simultaneous manner to effect scheduled movements.

- Routine Movements removes ABLKS from pending assignment sets at each base, every month, enters them into travel pipes according to specified destination and removes the equivalent size of the ABLK from the skill and level supply at the base.

- Routine Check Pipe examines the current volume of the travel pipes relative to capacity, to determine if ABLKS received from Routine Movements can be entered directly into the pipe or queued to await a reduction in volume.

- Routine Check School examines the current volume of the training pipes relative to capacity to determine if ABLKS exiting travel pipes with a training purpose can be entered directly into training or queued to await the start of the next class.

- Routine Graduation matches ABLKS exiting training pipes with ABLKS in graduation disposition pools and enters matched assignments into travel pipes.

- Routine Find Assignment searches bases for any cancellation ABLKS with LEVY codes and creates new ABLKS to assign uncommitted training and rotation supplies remaining in the current time period.

The basic logic flow executed in the operation of these five routines is outlined below:

(1) Routine Movements calls Routine Check Pipe and enters ABLKS into waiting queues or travel pipes according to the volume/capacity status of the pipes.

(2) Entering an ABLK into a travel pipe automatically schedules a pipe exit event for a period equal to current time plus travel time.

(3) Pipe exit events remove ABLKS from travel pipes according to schedule and places them into base personnel supplies or training pipes according to ABLK specifications. If training pipe entry is specified, then Routine Check School is called to enter ABLKS into waiting queues or training pipes depending on the current volume/capacity status.

(4) Entering an ABLK into a training pipe automatically schedules a graduation event for a time period equal to current time plus training time.

(5) Graduation events transfer control of ABLKS to the Graduation Routine which matches them with disposition ABLKS. Matched ABLKS are then subject to control by Routine Movements which places them in travel pipes to the appropriate destination.

(6) If graduation ABLKS are insufficient to meet disposition requirements, then unfulfilled dispositions are carried over to the next graduation cycle.

(7) If a surplus of graduation ABLKS exists relative to disposition then Routine Find Assignment is called to create ABLKS for the disposition of the surplus graduates. Find Assignment can also be called from Routine Movements if surpluses of rotation supplies are detected relative to pending assignments in the current time period.

3.0 PROGRAM OUTPUT AND REPORT GENERATION

In order to facilitate user flexibility in analyzing program output from ISEM-P, all report generation is performed by a Data Post-Processing Program which is separate from the central simulation model. Input to this program consists of a detailed, formatted record of the value of every system state, policy and planning variable for each month and/or year in a multi-year simulation run. Although all of these data may not be required for any given analysis or report, the detailed output record can be cataloged and stored for future reference or analysis. Keeping these full-scale output records, eliminates the need to make expensive and time-consuming reruns of a previous simulation just be record some additional data which was not monitored in the initial run.

The Data Post Processor is designed to be interactive with batch options for large report requests. The user may specify the format of tabular outputs from three standardized report options. Two-dimensional line printer plotting can also be requested for time trajectory or cross-variable plots. The following parameters are also available to the user to specify the desired type, aggregation and frequency of state, policy or planning variables he wishes to be reported:

(1) Variable Type: Supply, Authorization, Training Requirement, Pipe Volumes, Manpower Requirements, Assignments, Delays, Separations.

(2) Variable Aggregation: Skill, Skill Level, Mission, Base, MAJCOM, Grade, Year Group, Location.

(3) Variable Frequency: Months, Years, Year Aggregations.

Specification of these parameters will result in the performance of desired summations, cross-tabulations and frequency calculations. Reports would then be generated according to format specifications and any requested plots would be made for specified variable pairs. See Attachment 3 for examples of tabular format and plotting options.

ATTACHMENT 1: Model Bases

Base No.	Base Name		Location	MAJCOM
	Model	Actual		
1	Training 1	Lackland	San Antonio, Tx.	ATC
2	Training 2	Lowry	Denver, Col.	ATC
3	Training 3	Williams	Mesa, Ariz.	ATC
4	APOE East	McGuire	Trenton, N. J.	MAC
5	APOE West	Travis	Fairfield, Calif.	MAC SAC(T)
6	Operations 1	Homestead	Homestead, Fla.	TAC
7	Operations 2	Ellsworth	Rapid City, S. D.	SAC
8	Operations 3	Grand Forks	Grand Forks, N. D.	SAC
9	Operations 4	Loring	Limestone, Maine	SAC
10	Operations 5	Pope	Fayetteville, N. C.	MAC
11	Operations 6	Shaw	Sumter, S. C.	TAC
12	Operations 7	Mountain Home	Boise, Idaho	TAC
13	Operations 8	George	Victorville, Calif.	TAC
14	Overseas 1	Bitburg	Bitburg, W. Germany	USAFE
15	Overseas 2	Alconbury	Alconbury, U. K.	USAFE
16	Overseas 3	Kadena	Kadena, Okinawa	PACAF
17	Overseas 4	Kunsan	Kunsan, Korea	PACAF

ATTACHMENT 2: Model Skills

Skill Number	Skill Name	Skill Number	Skill Name
1	Aerial Gunner	36	Metalworking
2	Refuel Operator	37	Mechanical/Electrical Maintenance
3	Loadmaster		
4	Intelligence	38	Civil Engineering
5	Photomapping	39	Fire Protection
6	Weather	40	Transportation
7	Air Operations	41	Food Service
8	Air Traffic Control	42	Fuel Service
9	Detection and Deployment	43	Supply
10	Telecommunications Operations	44	Procurement
		45	Accounting and Finance
11	Radio Operator	46	Administration
12	Weather Equipment Repair	47	Manpower/Personnel
13	Radar Equipment Repair	48	Education and Training
14	Radio Equipment Repair	49	Security Police
15	Computer Systems Repair	50	Medical/Dental
16	Communications and Crypto Equipment Repair	51	Aircrew Protection
		52	C-141 Pilot
17	Bombing and Navigation Systems Mechanic	53	C-130 Pilot
		54	KC-135 Pilot
18	FCS Mechanic	55	F-4 Pilot
19	Weapons Control Systems Mechanic	56	F-111 Pilot
		57	B-52 Pilot
20	Flight Control and Instrumentation	58	RF-4 Pilot
		59	Flight Training Instructor
21	Integrated Avionics	60	C-130 Air Operations Officer
22	Avionics/Guidance		
23	Instrument Trainer	61	C-141 Air Operations Officer
24	Defensive Systems Trainer		
25	Navigation/Bombing/ Tactics Trainer	62	B-52 Air Operations Officer
26	Wire Communications System Maintenance	63	KC-135 Air Operations Officer
27	Aircraft Accessory Repair	64	F-4 Air Operations Officer
28	Aircraft Maintenance - Propellor	65	F-111 Air Operations Officer
29	Aircraft Maintenance - Jet		
30	Jet Engine Mechanic	66	RF-4 Air Operations Officer
31	Propellor Engine Mechanic		
32	Munitions Maintenance	67	UPT Air Operations Officer
33	Weapons Mechanic		
34	Vehicle Maintenance	68	B-52 Navigator
35	Computer Systems Operations	69	KC-135 Navigator

ATTACHMENT 2 (continued)

Skill Number	Skill Name
70	C-130 Navigator
71	C-141 Navigator
72	F-4 Navigator
73	RF-4 Navigator
74	F-111 Navigator
75	B-52 EWO
76	Air Traffic Control
77	Weapons Control
78	Weather
79	Communications/Electronics Systems
80	Computer Maintenance
81	Aircraft Maintenance/Avionics
82	Munitions
83	Computer Technology
84	Civil Engineering
85	Chartography
86	Transportation
87	Supply
88	Fuels
89	Procurement
90	Financial
91	Administration
92	Personnel/Manpower
93	Education/Training
94	Intelligence
95	Security Police
96	Biomedical
97	Physician
98	Nurse
99	Dental
100	Veterinarian

ATTACHMENT 3: Output Display Options Designed for ISEM-P

(Examples of output formats actually used in prototype testing are contained in Attachment 4)

I. Purpose of the Display Package

A. Information and Reference

1. Organizational Structure
2. Information and Decision Flow
3. System Delay or Failure Identification
4. Stratified Force Structure Data
5. Management Status

B. Analysis

1. Quantification of System Time Response
2. Statistical Profiles of Force Structure
3. Supply-Demand Comparisons
4. Quantification of Services Delivery

C. Evaluation

1. Decision Process Efficiency
2. Communications Adequacy
3. Augmentation Capability
4. Training Capacity

II. Output Data Generation

A. User Inputs

1. Variable Monitoring Specifications
2. Frequency Specifications
3. Aggregation Requirements

B. Data File Creation

1. Identify, Record and Store
2. Perform Required Manipulations
   a. Aggregation
   b. Cross-Tabulation
   c. Ordering
   d. Percentages
   e. Matching
   f. Formatting
3. Index and Catalogue

III. User Display Options

A. Data Set Selection

1. Total or Sampled File Output
2. Matched Files, e.g., Requirements and Actual Levels
3. Comparative Files, e.g., Two Related Skill Trajectories
4. Sequential Time Files
5. Cross-Sectional Time Files
6. Reference File Dumps

B. Output Format Selection

1. Tabular
   a. Time Stratification
   b. Single/Multiple Cell Entries, e.g., Absolutes and Percentages
   c. Variable Codes or Names
   d. Subtotals and/or Totals
   e. Organization or Process
2. Graphical
   a. Time Scale
   b. Variable Scale
   c. Discrete or Overlay Plots
   d. Intersection Indicators
   e. Histogram Vertical/Horizontal
   f. Unit or Grouped Distributions

IV. Output Display Formats

A. General Comments

1. Time Groupings and Scales are Limited to:
   a. Years
   b. Years/Months
   c. Years/Bi-Weekly
2. Variable Descriptors are:
   a. Location
   b. Specialty
   c. Skill Level
   d. Service or Assignment Incumbency
   e. Function
   f. Command

3. Any Grouping of the Above Descriptors Can Be Output in Tabular or Plot Format
4. Cell Entries and Plot Points Can Represent:
   a. Absolute Personnel Numbers: Actual, Required, Authorized, Projected, Levied or Frozen
   b. Percentage Level Changes Over Time
   c. Percentage of Authorized or Required Level
   d. Abnormal Fluctuations as Measured by a Predetermined Norm, e.g., Levels Incurring a Greater Than 20 Percent $\pm$ Fluctuation

B. Tabular Options

1. One Dimensional Personnel Levels - T-1
2. Two Dimensional Personnel Levels - T-2
3. "n" by Two Dimensional Personnel Levels - T-3
   a. Two Dimensions are Explicit
   b. Cell Entries Imply a Grouping of Remaining Descriptors
4. Unit Dimension Summaries - T-4
   a. Simple Accounting of Personnel by Each Descriptor in a Given Time Period
   b. Percent Change from Previous Summary is Output
5. Pipeline Occupancy - Training - T-5
   a. Number in Training is Stratified by Purpose Code (e.g., TDY Enroute Overseas) for a Given Time Period
   b. Occupancy is Geographically Stratified With Duration in Weeks or Month Groups
6. Pipeline Occupancy - Travel - T-6
   a. Number in Pipeline is Specified for a Given Travel Purpose and Time Period
   b. Travel is Geographically Stratified and Duration can be Day or Week Groupings
7. Pipeline Status - Training - T-7
   a. Volume and Capacity are Indicated as Number of Personnel in a Given Time Period
   b. Delay is in Days or Weeks as a Function of Queue Length
   c. Queue Length is Number Exceeding Capacity in a Given Time Period

8. Reference Listing: PIC Organization (Node) File - T-8*
   a. Organization Codes are the Office Letter Codes
   b. Classification Refers to Active (a transaction takes place), Passive (receipt of information), or Dummy (a routing point)
9. PIC Decision Sequence - Organizations - T-9*
   a. Sequence Number is Order in Which Decisions are Made
   b. Decision/Action is a General Description of Transaction to Take Place, e.g., Approve, Cancel or Reclama
10. PIC Decision Sequence - Network - T-10*
   a. Purpose Code Describes Reason for Linkage, e.g., Information Transfer or Request for Decision
   b. Flow Description is the Transaction Code Assigned by APDS
   c. Link Time is a Distributed Delay in Days or Weeks
   d. Frequency Describes a Continuous Flow Situation
11. PIC Organizational Status Summary - T-11*
   a. Transactions are the Numbers Processed Through a Given Organization for the Specified Purpose
   b. Queues and Delays are as Described Earlier (7-b, c)
12. PIC Process Status - Network Summary - T-12*
   a. Summarize One Process Through all Organizations for a Given Time Period
   b. Column Descriptions are as Above (T-11)
13. "n" Dimensional Threshold Encroachments - T-13
   a. Categories can Reflect a Grouping of up to Six Descriptors
   b. Threshold Levels are Predetermined
   c. Violations are Based on a Linear Projection of Recent Months' Drawdown

C. Graphical Options

1. Single Variable Plots - P-1
2. Two Variable Plots
   a. Option 1 (P-2) - Plot Points Represent Grouped Data for Two Selected Descriptors

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*Not available in ISEM-P.

b. Option 2 (P-3) - Same as Option 1 Except All Stratifications of One Descriptor Are Shown As Separate Plots on One Graph

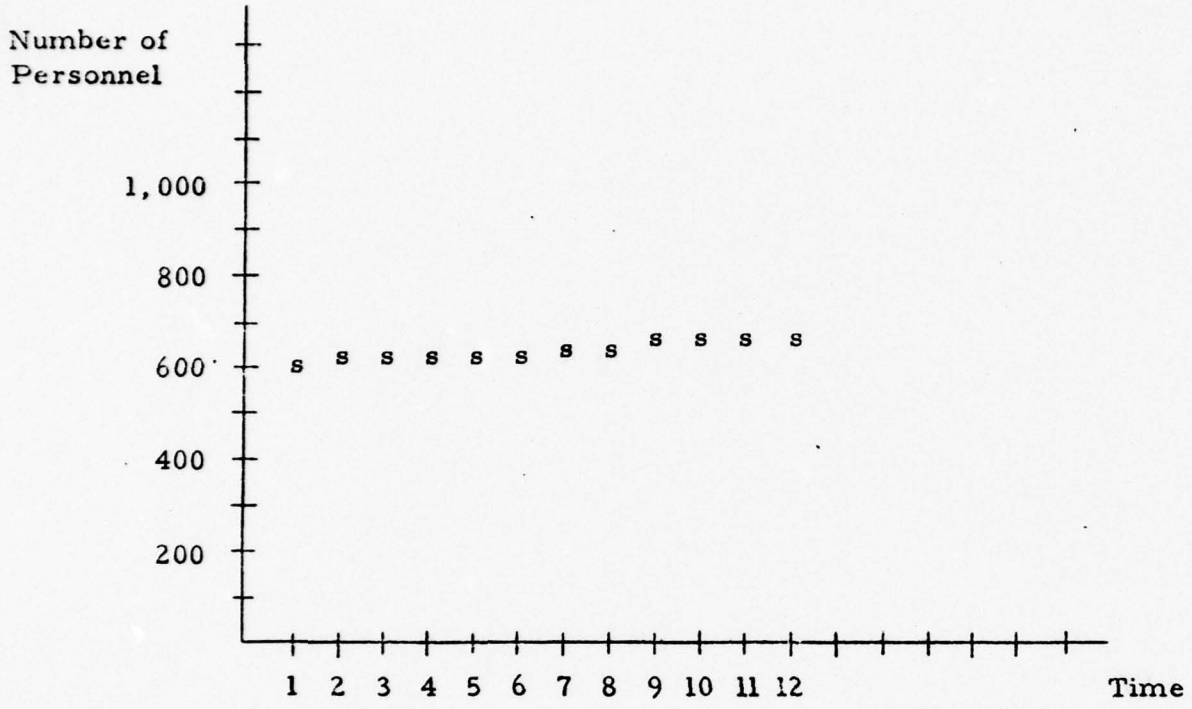
3. "n" Variable Plots - P-4
4. Requirements/Authorization Overplots - P-5
   a. Actual Levels are Plotted with Requirements or Authorization Over Time
   b. Intersections are Indicated by a Unique Letter, e.g., "I"
5. Cross-Variable Overplots - P-6
   a. Comparison of Two Different Primary Variables
   b. More Than Two Variables can be Accommodated
6. Unit Variable Distribution - P-7
7. Grouped Variable Distributions
   a. Option 1 (P-8) - Horizontal Histograms
   b. Option 2 (P-9) - Vertical Histograms

D. Plotting Mechanics

1. Scaling Will be With Linear Interpolation Between Minimum and Maximum Data Points
2. Expanded Scales Will Be Used for Clarity When Maximums are Relatively Small, i.e., Less than 100
3. Explicit Curvature Cannot Be Represented Due to Line Spacing
4. Overplots Will Be Accomplished Through Alternate Printing Of Two Buffers
5. Standard Scales Will Be Used When Appropriate
6. Multiple Plots Will Have Predetermined Intersection Codes
7. Printed Legends Can Be Used in Lieu of Variable Descriptions
8. Closely Parallel Plots Should Be Produced in Singular Rather Than Multiple Plot Format

Date: Run Title: Run Number:

Single Variable Plots P-1

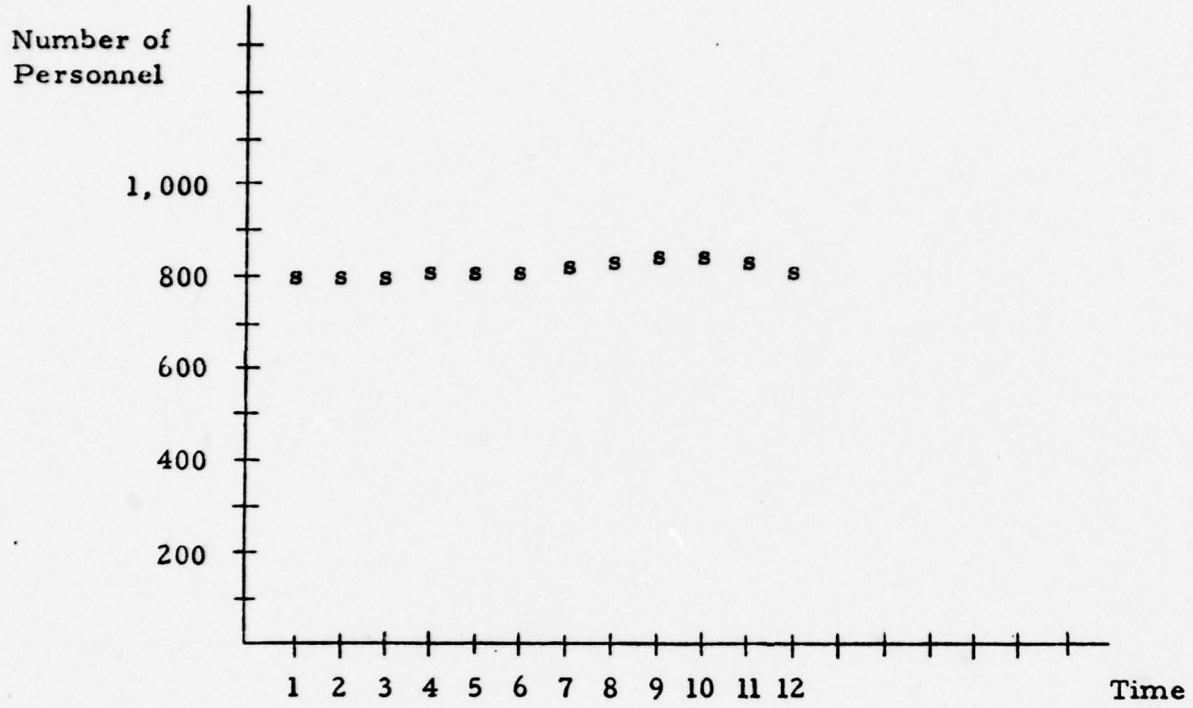


Variable Group: Skill
Plot Variable: 11xxx
Time Period: 1980

Scale Factors:
Y - 100
X - Month

Date: Run Title: Run Number:

Two Variable Plots - Option 1 P-2

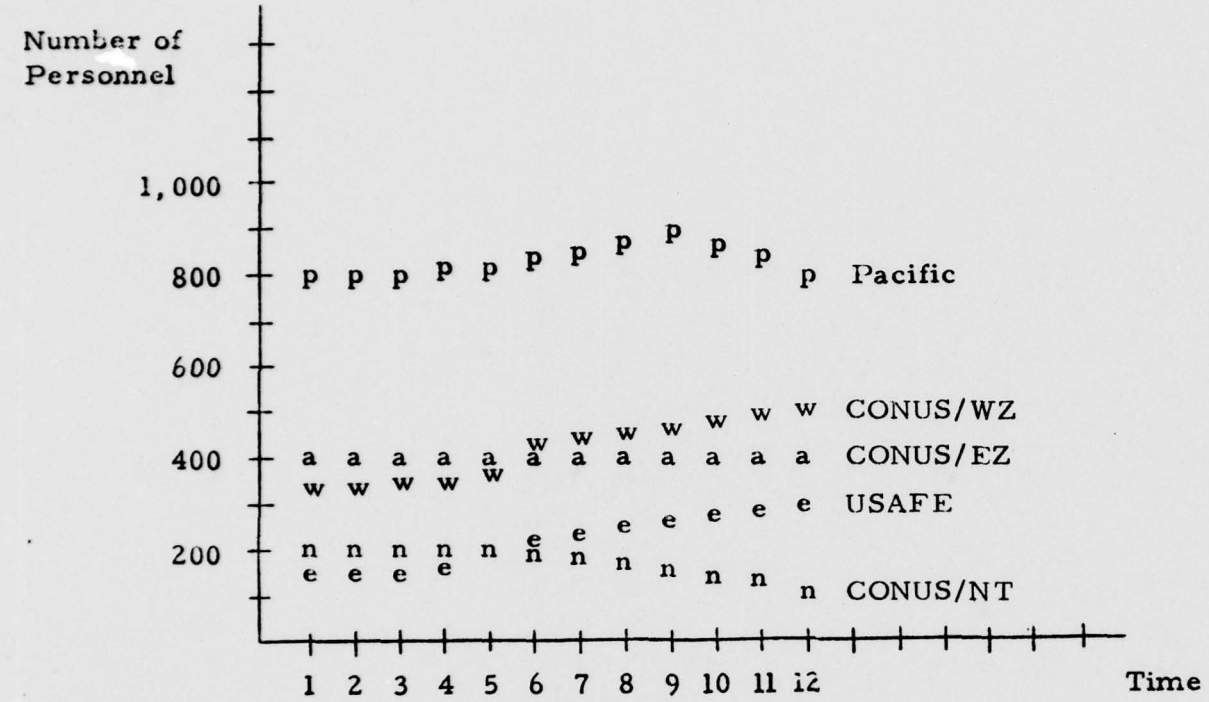


Variable Group: Skill X Location
Plot Variables: 11xxx/Pacific
Time Period: 1980

Scale Factors:
Y - 100
X - Month

Date: Run Title: Run Number:

Two Variable Plots - Option 2 P-3

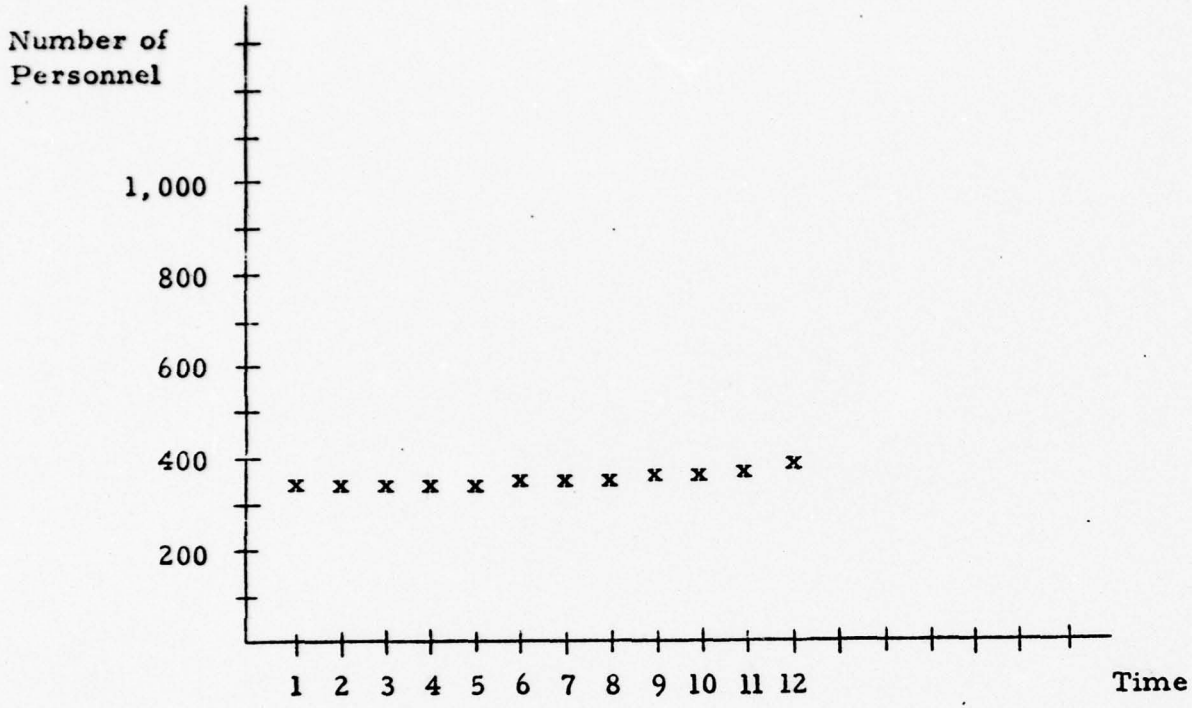


Variable Group: Skill X Location
Plot Variable: 11xxx
Time Period: 1980

Scale Factors:
Y - 100
X - Month

Date: Run Title: Run Number:

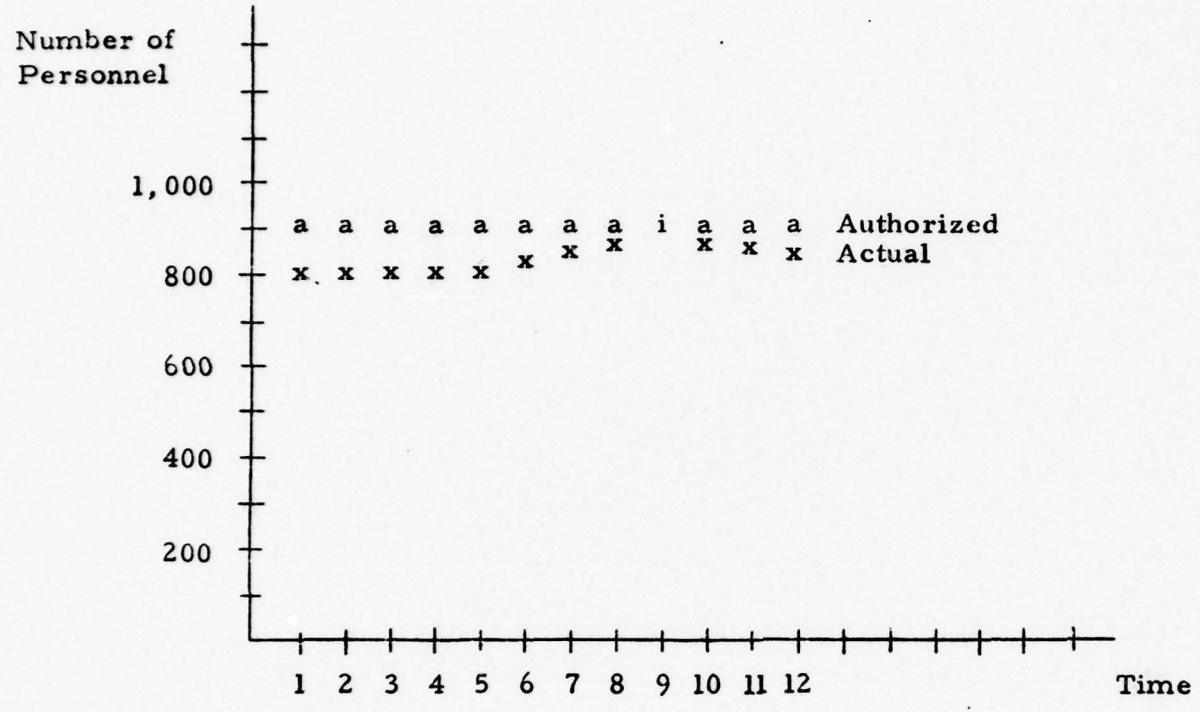
"n" Variable Plots P-4



Primary Variable Group:	Skill	Scale Factors:
Primary Plot Variable:	11xxx	Y - 100
Time Period:	1980	X - Month
Classification Variables:	Command/Location	
Plot Grouping:	SAC/CONUS-NT	

Date: Run Title: Run Number:

Requirements/Authorization Overplots P-5

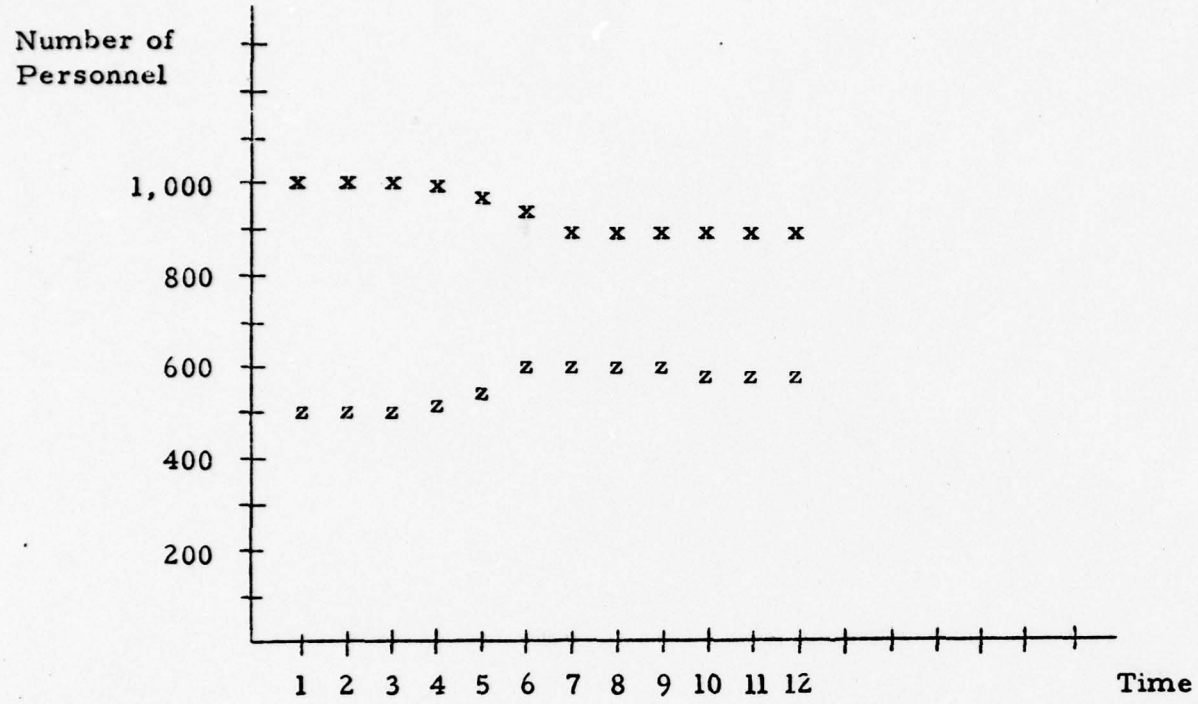


Primary Variable Group:	Skill	Scale Factors:
Primary Plot Variable:	11xxx	Y - 100
Time Period:	1980	X - Month
Classification Variables:	Skill Level/Location	
Plot Grouping:	A2/Pacific	

Date: Run Title: Run Number:

Cross-Variable Overplots

P-6

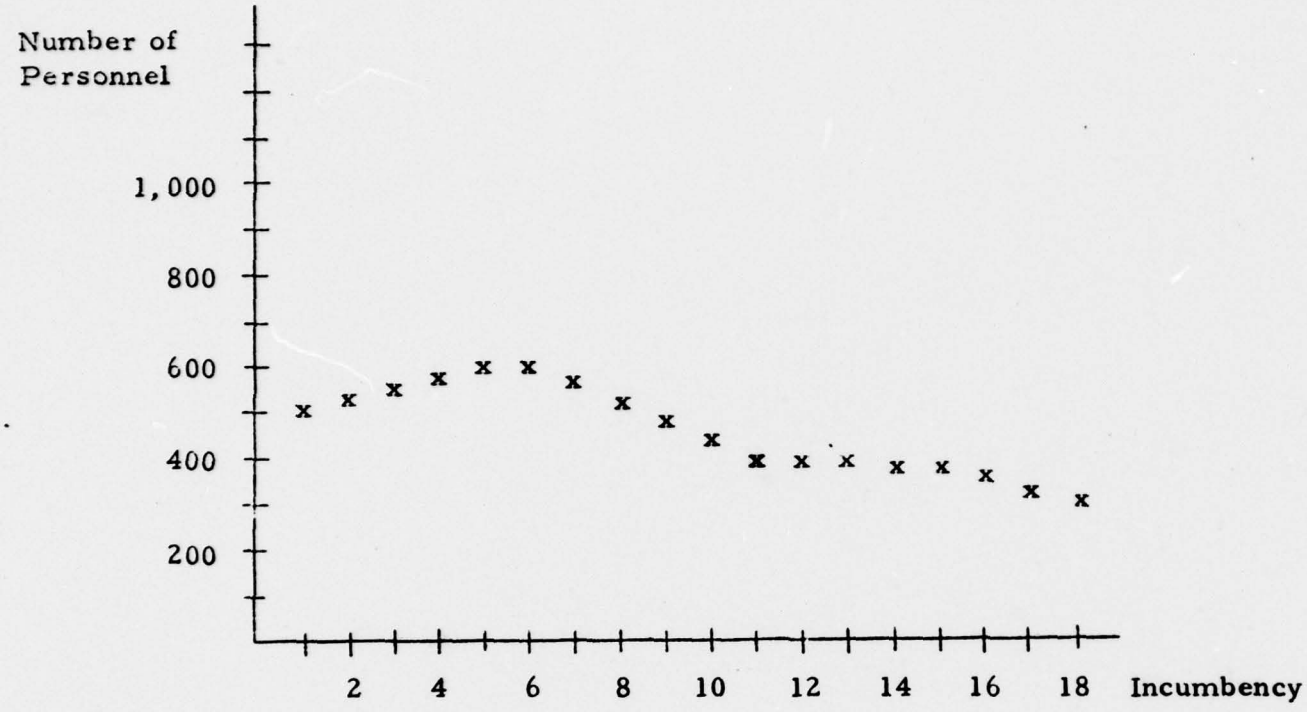


Primary Variable Group: Skill/Skill Level
Plot Groupings: X = 302 x 0/A2
Z = 303 x 0/A3
Time Period: 1980

Scale Factors:
Y - 100
X - Month

Date: Run Title: Run Number:

Unit Variable Distributions P-7

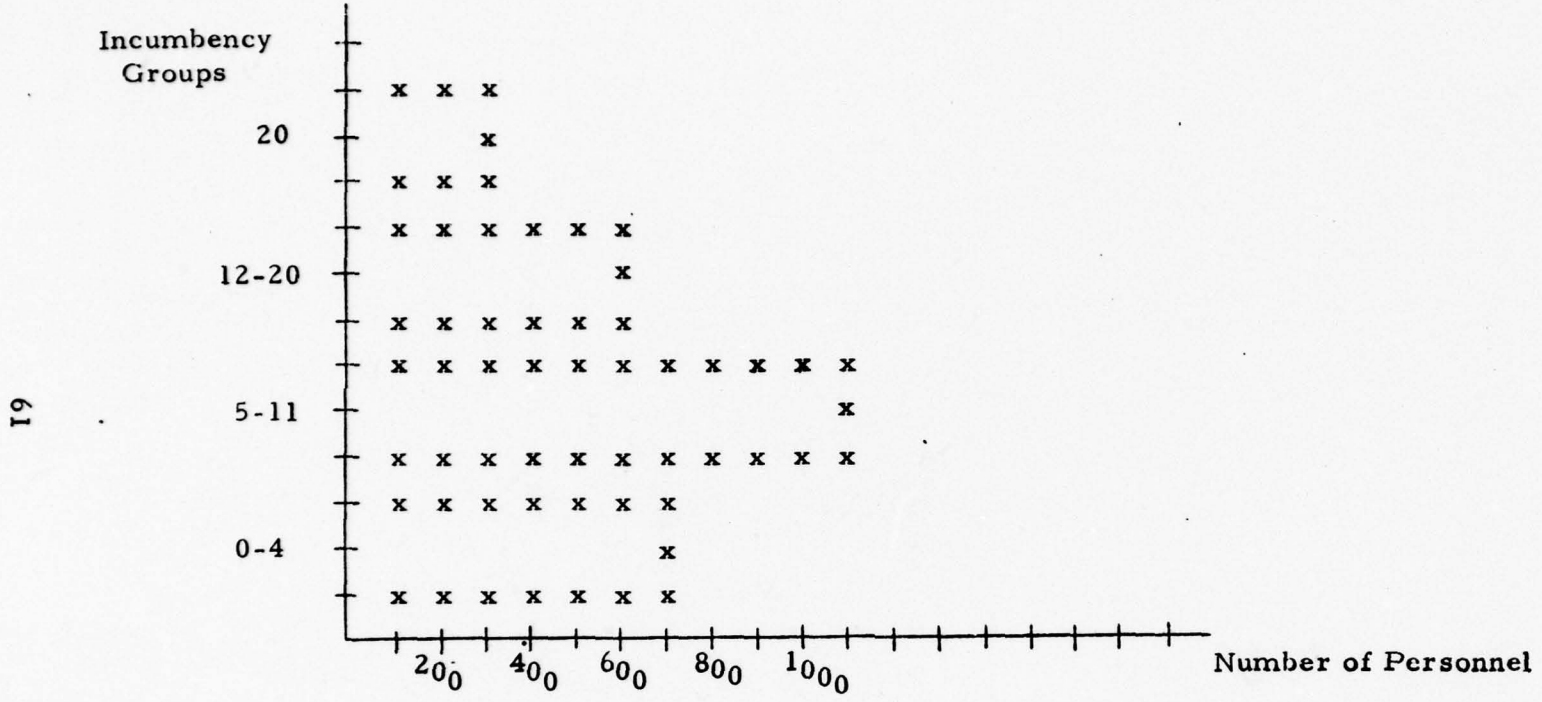


Variable Group: Skill
Plot Variable: 11xxx

Scale Factors:
Y - 100
X - Years

Date: Run Title: Run Number:

Grouped Variable Distributions - Option 1 P-8

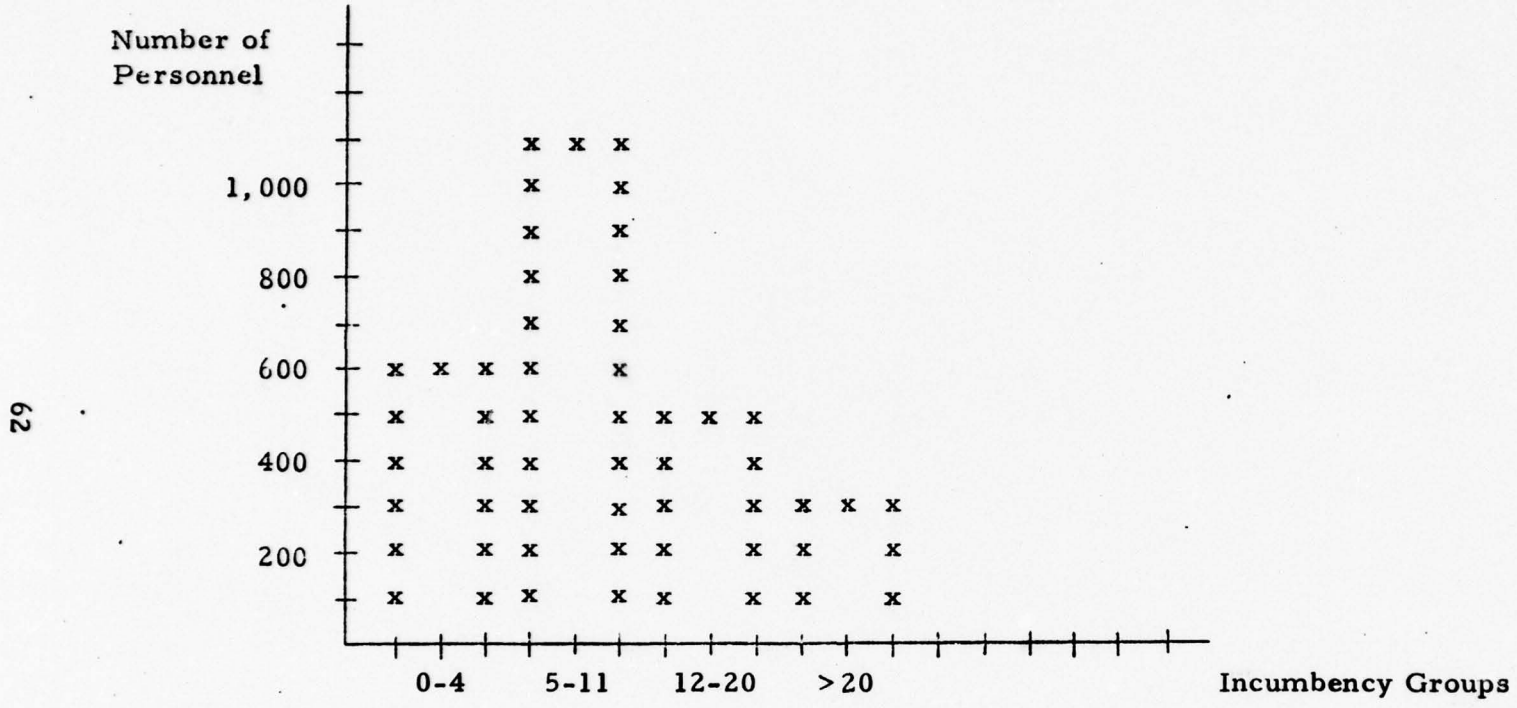


Variable Group: Skill
Plot Variable: 11xxx

Scale Factors:
X - 100
Y - Year Groups

Date: Run Title: Run Number:

Grouped Variable Distributions - Option 2 P-9



Variable Group: Skill
Plot Variable: 11xxx

Scale Factors:
X - Year Groups
Y - 100

Date: Run Title: Page:
Run Number:

One-Dimensional Personnel Levels T-1

Dimension Selected: Location
Time Increment: Year x Month
Baseline Date: December 1975

Dimensional Grouping	Year x Month 80-1	80-2	80-3	80-4	80-5	80-6	80-7	80-8 ----- 80-12	Grouping Total
Pacific									
European									
CONUS/Eastern Zone									
CONUS/Western Zone									
CONUS/Northern Zone									
Increment Total									

Date: Run Title: Page:
Run Number:

Two-Dimensional Personnel Levels T-2

Dimensions Selected: Location/Skill - Airman
Time Period: 80-1
Baseline Date: December 1975

Skill Category	Location PACAF	USAFE	CONUS/EZ	CONUS/WZ	CONUS/NT	Skill Category
11xxx						
111xx						
112x0						
113x0						
114x0						
20xxx						
.						
.						
.						
.						
.						
.						
98xxx						

Date: Run Title: Page:
Run Number:

"n" by Two-Dimensional Personnel Levels T-3

Primary Categories: MAJCOM-SAC
Dimensions Selected: Location/Skill - Airman
Time Period: 80-1
Baseline Date: December 1975

Skill Category	Location PACAF	USAFE	CONUS/EZ	CONUS/WZ	CONUS/NT	Category Totals
11xxx						
111xx						
112x0						
113x0						
114x0						
20xxx						
.						
.						
.						
.						
.						
.						
98xxx						
Location Totals						

Date: Run Title: Page:
Run Number:

Unit Dimension Summaries of Personnel T-4

Time Period: 80-1
Baseline Date: December 1975

Dimension/Grouping	Number of Personnel	% Change - Previous Period
Location/		
USAFE		
PACAF		
CONUS/NT		
.		
.		
.		
.		
Skill (Airman)/		
11xxx		
111xx		
112xx		
.		
.		
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.		
MAJCOM/		
SAC		
TAC		
MAC		
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Date: Run Title: Page:
Run Number:

Pipeline Occupancy Information - Training T-5

Purpose Code: A
Dimension Selected: Skill
Time Period 80-1
Baseline Date: December 1975

Dimension Grouping	CONUS/EZ			CONUS/WZ			CONUS/NT			PACAF/PAE			USAFE/PAE		
	<2	3-5	>5	<2	3-5	>5	<2	3-5	>5	<2	3-5	>5	<2	3-5	>5
11xxx															
111xx															
112xx															
113xx															
114xx															
20xxx															
.															
.															
.															
.															
.															
98xxx															

Date: Run Title: Page:
Run Number:

Pipeline Occupancy Information - Travel T-6

Purpose: TDY
Dimension Selected: Skill
Time Period: 80-1
Baseline Date: December 1975

Dimension Grouping	Intra CONUS			CONUS-PACAF			CONUS-USAFE		
	1	2	>3	1	2	>3	1	2	>3
11xxx									
111xx									
112xx									
113xx									
114xx									
20xxx									
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.									
.									
98xxx									

Date: Run Title: Page:
Run Number:

Pipeline Status Information - Training T-7

Time Period: 80-1
Baseline Date: December 1975

Training Sequence	Volume	Volume/ Capacity	Queue	Delay
Tactical Aircraft	2,020	0.67	---	-
Weapons System A	1,620	1.16	260	2
CONUS/EZ	150	0.75	---	-
CONUS/WZ	800	0.87	---	-
CONUS/NT	670	1.34	260	2
Weapons System B	400	0.25	---	-
CONUS/EZ	75	0.19	---	-
CONUS/WZ	25	0.06	---	-
CONUS/NT	300	0.75	---	-
Recon/Observation				
CONUS/EZ				
Transport/Airlift				
CONUS/EZ				
CONUS/NT				

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Date: Run Title: Page:
Run Number:

Reference Listing: PIC Organization (Node) File T-8

Node Reference	Organization Name	Organization Code	Classification
001	Con. Base Persn. Off.	CBPO	Process
002	Mil. Persn. Center	MPC	Process
003	Major Command	MAJCOM	Process

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Date: Run Title: Page:
Run Number:

PIC Decision Sequence Description - Organizations T-9

Process Selected: Separation/Non-ETS, Officer
Level Selected: Major

Sequence Number	Node Reference	Organization Code	Decision/Action Required
1	001	CBPO	Initiate
2	001	CBPO	Analyze/Forward
3	003	MAJCOM	Comment/Forward
4	002	MPC	Approve/Disapprove/Inform
5	003	MAJCOM	Reclama/Confirmation
6	001	CBPO	Cancel/Implement

Date: Run Title: Page:
Run Number:

PIC Decision Sequence - Network Description T-10

Process Selected:
Level Selected:

Sequence Number	Origin Node	Destination Node	Link Reference	Purpose Code	Flow Description	Link Time	Frequency
1	001	001	Intra	Authr.	Appl.	I	AR
2	001	002	12	Info.	970	D	AR
		003	13				
3	003	002	32	Info.	974	D	AR
4	002	001	21	Dec.	977/971	D	AR
		003	23				
5	003	002	32	Recl.	974	D	AR
6	001	002	12	Conf.	992	D	AR

Date: Run Title: Page:
Run Number:

PIC Decision Sequence - Network Description T-10

Process Selected: Separation/Non-ETS, Officer
Level Selected: Major

Sequence Number	Origin Node	Destination Node	Link Reference	Purpose Code	Flow Description	Link Time	Frequency
1	001	001	Intra	Authr.	Appl.	I	AR
2	001	002	12	Info.	970	D	AR
		003	13				
3	003	002	32	Info.	974	D	AR
4	002	001	21	Dec.	977/971	D	AR
		003	23				
5	003	002	32	Recl.	974	D	AR
6	001	002	12	Conf.	992	D	AR

Date: Run Title: Page:
Run Number:

PIC Organizational Status Summary T-11

Organization Code: MAJCOM
Time Period: 80-1

Processes Monitored	Current Transactions Pending	Transactions Completed This Period	Maximum Queue Length Encountered	Process Delay Incurred This Period
Separation	250	1,500	175	4
Officer	50	150	25	1
Airmen	200	1,350	150	3
Assignment				
Officer				
Airmen				
Promotion				
Officer				
Airmen				

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Date: Run Title: Page:
Run Number:

PIC Process Status - Network Summary T-12

Process Selected: Separation
Organizational Level: Major
Time Period: 80-1

Sequence Number	Organization Code	Node Reference	Transactions Pending	Transactions Completed	Max Queue Encountered	Process Delay Incurred
1	CBPO	001	150	700	0	0
2	CBPO	001	125	550	25	2
3	MAJCOM	003	75	675	0	0
4	MPC	002	50	480	75	1
5	MAJCOM	003	50	500	0	0
6	CBPO	001	300	600	150	3

Date: Run Title: Page:
Run Number:

"n" Dimensional Threshold Encroachments T-13

Encroachment Limit: 10%
Time Period: 80-1

Category Description	Threshold Level	Current Level	Violation Protection
1225/TAC/Pacific	3,700	3,990	80-6
1115/TAC/Pacific			
1045/MAC/CONUS-NT			
75xx/ATC/CONUS-EZ			

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ATTACHMENT 4: Output Data Formats Used for ISEM-P Testing

(Numbers used in these form examples are for demonstration only and do not reflect actual model output data.)

AIR FORCE SKILLS/LEVELS PLAN FOR YEAR 1 PAGE 1 SHEET 1

					AUTHZD	DESIRED	EXP.SEP	UPGRADE
SKILL(1)	AIR GUNNER	LEVEL(1)	HELPER		1	2	3	4
SKILL(1)	AIR GUNNER	LEVEL(2)	APPRENTICE		2	4	6	8
SKILL(1)	AIR GUNNER	LEVEL(3)	JOURNEYMAN		3	6	9	12
SKILL(1)	AIR GUNNER	LEVEL(4)	TECHNICIAN		4	8	12	16
SKILL(1)	AIR GUNNER	LEVEL(5)	SUPERVISOR		5	10	15	20
SKILL(1)	AIR GUNNER	LEVEL(6)	ARMN.TOTAL		15	30	45	60
SKILL(2)	REFUEL OPR	LEVEL(1)	HELPER		2	4	6	8
SKILL(2)	REFUEL OPR	LEVEL(2)	APPRENTICE		4	8	12	16
SKILL(2)	REFUEL OPR	LEVEL(3)	JOURNEYMAN		6	12	18	24
SKILL(2)	REFUEL OPR	LEVEL(4)	TECHNICIAN		8	16	24	32
SKILL(2)	REFUEL OPR	LEVEL(5)	SUPERVISOR		10	20	30	40
SKILL(2)	REFUEL OPR	LEVEL(6)	ARMN.TOTAL		30	60	90	120
SKILL(3)	LOADMASTER	LEVEL(1)	HELPER		3	6	9	12
SKILL(3)	LOADMASTER	LEVEL(2)	APPRENTICE		6	12	18	24
SKILL(3)	LOADMASTER	LEVEL(3)	JOURNEYMAN		9	18	27	36
SKILL(3)	LOADMASTER	LEVEL(4)	TECHNICIAN		12	24	36	48
SKILL(3)	LOADMASTER	LEVEL(5)	SUPERVISOR		15	30	45	60
SKILL(3)	LOADMASTER	LEVEL(6)	ARMN.TOTAL		45	90	135	180
SKILL(4)	INTELLIGNC	LEVEL(1)	HELPER		4	8	12	16
SKILL(4)	INTELLIGNC	LEVEL(2)	APPRENTICE		8	16	24	32
SKILL(4)	INTELLIGNC	LEVEL(3)	JOURNEYMAN		12	24	36	48
SKILL(4)	INTELLIGNC	LEVEL(4)	TECHNICIAN		16	32	48	64
SKILL(4)	INTELLIGNC	LEVEL(5)	SUPERVISOR		20	40	60	80
SKILL(4)	INTELLIGNC	LEVEL(6)	ARMN.TOTAL		60	120	180	240
SKILL(5)	PHOTOMAPNG	LEVEL(1)	HELPER		5	10	15	20
SKILL(5)	PHOTOMAPNG	LEVEL(2)	APPRENTICE		10	20	30	40
SKILL(5)	PHOTOMAPNG	LEVEL(3)	JOURNEYMAN		15	30	45	60
SKILL(5)	PHOTOMAPNG	LEVEL(4)	TECHNICIAN		20	40	60	80
SKILL(5)	PHOTOMAPNG	LEVEL(5)	SUPERVISOR		25	50	75	100
SKILL(5)	PHOTOMAPNG	LEVEL(6)	ARMN.TOTAL		75	150	225	300

AIR FORCE SKILLS/LEVELS PLAN FOR YEAR 1 PAGE 20 SHEET 28

					AUTHZD	DESIRED	EXP.SEP	UPGRADE
SKILL(92)	TOTAL.ARMN	LEVEL(	1)	HELPER	1326	2652	3978	5304
SKILL(92)	TOTAL.ARMN	LEVEL(	2)	APPRENTICE	2652	5304	7956	10608
SKILL(92)	TOTAL.ARMN	LEVEL(	3)	JOURNEYMAN	3978	7956	11934	15912
SKILL(92)	TOTAL.ARMN	LEVEL(	4)	TECHNICIAN	5304	10608	15912	21216
SKILL(92)	TOTAL.ARMN	LEVEL(	5)	SUPERVISOR	6630	13260	19890	26520
SKILL(92)	TOTAL.ARMN	LEVEL(	6)	ARMN.TOTAL	19890	39780	59670	79560
SKILL(93)	TOTAL.OFFS	LEVEL(	1)	LIEUTENANT	2860	5720	8580	11440
SKILL(93)	TOTAL.OFFS	LEVEL(	2)	CAPTAIN	5720	11440	17160	22880
SKILL(93)	TOTAL.OFFS	LEVEL(	3)	MAJOR	8580	17160	25740	34320
SKILL(93)	TOTAL.OFFS	LEVEL(	4)	LT.COLONEL	11440	22880	34320	45760
SKILL(93)	TOTAL.OFFS	LEVEL(	5)	COLONEL	14300	28600	42900	57200
SKILL(93)	TOTAL.OFFS	LEVEL(	6)	OFFS.TOTAL	42900	85800	128700	171600

17 OVERSEAS KUNSAN AIR BASE STATUS REPORT FOR YEAR 1 MONTH 1 PAGE 5 SHEET 49

			FLOW							ASSIGN					PLAN	
			D.SUP	SEPNS	OJT.UP	SCHOOL	A.OJT	A.IN	OJT.IN	P.SUP	SEPNS	OJT UP	SCHOOL	A.OUT	A.SUP	D.MPR
64/1	RF-4.NAVI	LIEUTENANT	66	67	68	69	70	71	-0	132	134	136	138	140	64	256
64/2	RF-4.NAVI	CAPTAIN	67	68	69	70	71	72	-0	134	136	138	140	142	128	512
64/3	RF-4.NAVI	MAJOR	68	69	70	71	72	73	-0	136	138	140	142	144	192	768
64/4	RF-4.NAVI	LT.COLONEL	69	70	71	72	73	74	-0	138	140	142	144	146	256	1024
64/5	RF-4.NAVI	COLONEL	70	71	72	73	74	75	-0	140	142	144	146	148	320	1280
64/6	RF-4.NAVI	OFFS.TOTAL	340	345	350	355	360	365	0	680	690	700	710	720	960	3840
65/1	F111.NAVI	LIEUTENANT	67	68	69	70	71	72	-0	134	136	138	140	142	65	260
65/2	F111.NAVI	CAPTAIN	68	69	70	71	72	73	-0	136	138	140	142	144	130	520
65/3	F111.NAVI	MAJOR	69	70	71	72	73	74	-0	138	140	142	144	146	195	780
65/4	F111.NAVI	LT COLONEL	70	71	72	73	74	75	-0	140	142	144	146	148	260	1040
65/5	F111.NAVI	COLONEL	71	72	73	74	75	76	-0	142	144	146	148	150	325	1300
65/6	F111.NAVI	OFFS.TOTAL	345	350	355	360	365	370	0	690	700	710	720	730	975	3900
66/1	B-52.EWO	LIEUTENANT	68	69	70	71	72	73	-0	136	138	140	142	144	66	264
66/2	B-52.EWO	CAPTAIN	69	70	71	72	73	74	-0	138	140	142	144	146	132	528
66/3	B-52.EWO	MAJOR	70	71	72	73	74	75	-0	140	142	144	146	148	198	792
66/4	B-52.EWO	LT.COLONEL	71	72	73	74	75	76	-0	142	144	146	148	150	264	1056
66/5	B-52.EWO	COLONEL	72	73	74	75	76	77	-0	144	146	148	150	152	330	1320
66/6	B-52.EWO	OFFS.TOTAL	350	355	360	365	370	375	0	700	710	720	730	740	990	3960
67/1	AIR.TR.CTL	LIEUTENANT	69	70	71	72	73	74	-0	138	140	142	144	146	67	268
67/2	AIR.TR.CTL	CAPTAIN	70	71	72	73	74	75	-0	140	142	144	146	148	134	536
67/3	AIR.TR.CTL	MAJOR	71	72	73	74	75	76	-0	142	144	146	148	150	201	804
67/4	AIR.TR.CTL	LT.COLONEL	72	73	74	75	76	77	-0	144	146	148	150	152	268	1072
67/5	AIR.TR.CTL	COLONEL	73	74	75	76	77	78	-0	146	148	150	152	154	335	1340
67/6	AIR.TR.CTL	OFFS.TOTAL	355	360	365	370	375	380	0	710	720	730	740	750	1005	4020
68/1	WEAPS CNTL	LIEUTENANT	70	71	72	73	74	75	-0	140	142	144	146	148	68	272
68/2	WEAPS CNTL	CAPTAIN	71	72	73	74	75	76	-0	142	144	146	148	150	136	544
68/3	WEAPS CNTL	MAJOR	72	73	74	75	76	77	-0	144	146	148	150	152	204	816
68/4	WEAPS CNTL	LT COLONEL	73	74	75	76	77	78	-0	146	148	150	152	154	272	1088
68/5	WEAPS CNTL	COLONELL	74	75	76	77	78	79	-0	148	150	152	154	156	340	1360
68/6	WEAPS.CNTL	OFFS.TOTAL	360	365	370	375	380	385	0	720	730	740	750	760	1020	4080

SCHOOLS AND PIPES FOR YEAR/MONTH/PAGE/SHEET 1 1 21 73

	C ENROLL	V. ENROLL	GRADS	SCH. QUE	SCH. PEAK	X. GRADS	X. ENROLL	C. VOL	TVL. VO.	PK. VOL	WAIT. QUE	PEAK. QUE
1	4	7	12	19	29	1	1	1	8	27	64	125
2	5	11	21	35	53	2	4	2	16	54	128	250
3	6	15	30	51	79	3	9	3	24	81	192	375
4	7	19	39	67	103	4	16	4	32	108	256	500
5	8	23	48	83	129	5	25	5	40	135	320	625
6	9	27	57	99	153	6	36	6	48	162	384	750
7	10	31	66	115	179	7	49	7	55	189	448	875
8	11	35	75	131	203	8	64	8	64	216	512	1000
9	12	39	84	147	228	9	81	9	72	243	576	1125
10	13	43	93	163	253	10	100	10	80	270	640	1250
11	14	47	102	179	279	11	121	11	88	297	704	1375
12	15	51	111	195	303	12	144	12	95	324	768	1500
13	16	55	120	211	328	13	169	13	104	351	832	1625
14	17	59	129	227	353	14	195	14	112	378	896	1750
15	18	63	138	243	379	15	225	15	120	405	960	1875
16	19	67	147	259	403	16	256	16	128	432	1024	2000
17	20	71	156	275	428	17	289	17	136	459	1088	2125
18	21	75	165	291	453	18	324	18	144	486	1152	2250
19	22	79	174	307	478	19	361	19	152	513	1216	2375
20	23	83	183	323	503	20	400	20	160	540	1280	2500
21	24	87	192	339	528	21	441	21	168	567	1344	2625
22	25	91	201	355	553	22	484	22	176	594	1408	2750
23	26	95	210	371	578	23	529	23	184	621	1472	2875
24	27	99	219	387	603	24	576	24	192	648	1536	3000
25	28	103	228	403	628	25	625	25	200	675	1600	3125
26	29	107	237	419	653	26	676	26	208	702	1664	3250